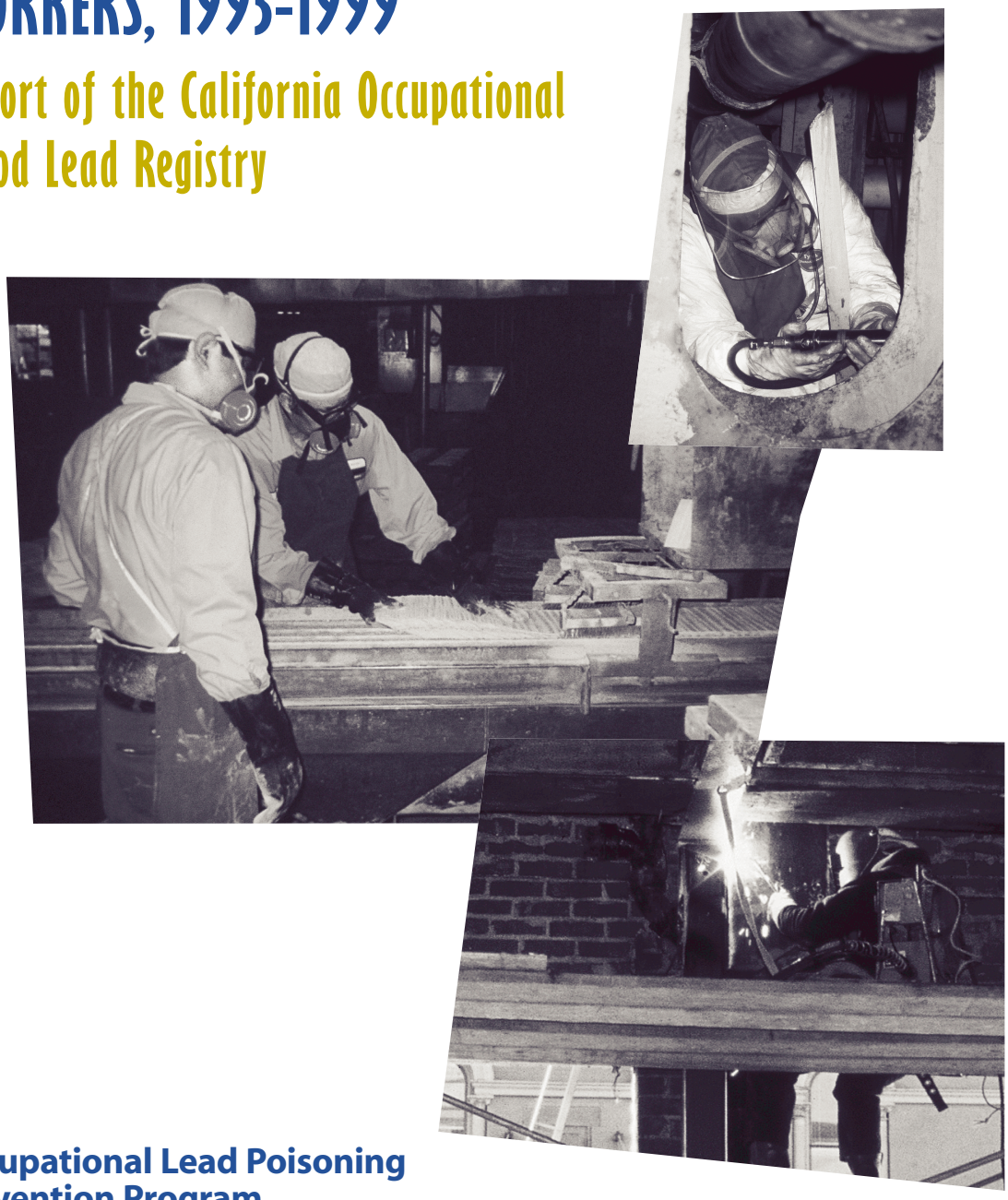
BLOOD LEAD LEVELS IN CALIFORNIA WORKERS, 1995-1999

Report of the California Occupational Blood Lead Registry



Occupational Lead Poisoning Prevention Program

Occupational Health Branch

California Department of Health Services

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EXECUTIVE SUMMARY

Lead poisoning continues to be a serious occupational health problem in California. The California Department of Health Services (CDHS) received thousands of reports of elevated blood lead levels (25 micrograms per deciliter or greater) in workers during the five-year period from January 1, 1995 to December 31, 1999 (2,657 individuals). Since the majority of lead-exposed workers never receive a blood lead level test, this figure significantly underestimates the extent of work-related lead poisoning in California.

Overexposure to lead causes serious health effects in adults, including injury to the nervous system, kidneys, blood-forming, and reproductive systems in men and women. The blood lead level reflects the amount of lead currently found in the blood and soft tissues. This may be from recent external exposure as well as from the slow release of any lead stored in bones from past exposures. There is no known "safe" level of lead in the blood.

Laboratories performing blood lead analyses on California residents are required to report blood lead levels (BLLs) 25 micrograms of lead per deciliter of blood (µg/dl) or greater to the CDHS. The Occupational Lead Poisoning Prevention Program (OLPPP) within CDHS receives reports for adults 16 years of age and over who are exposed to lead in the workplace. These data are recorded in the **California Occupational Blood Lead Registry** operated by OLPPP. OLPPP uses these data to identify serious cases of work-related lead poisoning requiring follow-up, estimate the magnitude and distribution of lead poisoning in California industries, and identify high risk industries for targeted prevention activities.

In this report we summarize the findings for 1995-1999, describe the operation of the system, discuss its limitations, review Registry-guided prevention efforts in high-risk industries, and review the efforts of CDHS/OLPPP to improve tracking of work-related lead poisoning in California.

Key Findings

Key findings of the Registry for the period 1995-1999 are:

- Elevated blood lead level reports (25 µg/dl or greater) were received for 2,657 individuals. Five hundred fifty-seven had a peak BLL 40 µg/dl or greater and may have suffered serious damage to their health.
- The overwhelming majority of individuals (94%) reported to the

Registry were male, with an age range typical of a working population (95% between 20 and 59 years of age).

- Individuals with Spanish surnames were disproportionately represented; California's workforce is 28% Hispanic, whereas the proportion of Spanish surnames among individuals reported to the Registry was 52%.
- A large proportion (42%) of workers with BLLs 25 µg/dl or greater were employed in Los Angeles County. This reflects the concentration of California lead industries in this county.
- Reports of elevated BLLs were not confined to a few industries; individuals reported to the Registry worked in 117 different industries.
- The majority of persons reported to the Registry with elevated BLLs worked in manufacturing (64%) including lead-acid battery manufacture, nonferrous secondary smelters, and manufacture of non-tableware pottery products. Individuals were also employed in construction (18%) and service industries (13%). Construction industries include painting, wrecking and demolition, and masonry (furnaces in lead smelters). Service industries include radiator repair shops and firing ranges.
- Progress has been made in reducing worker lead exposure in the lead-acid battery manufacturing and battery recycling industries; since 1995 no battery workers have been identified with BLLs 60 µg/dl or greater. However, the hundreds of individuals with elevated BLLs indicate that additional effort is needed to reduce worker exposure.
- Thirty-nine cases of workers with serious lead poisoning (BLLs ranging from 60 to 221 µg/dl) and 41 cases of take-home lead poisoning (40 children and one adult with BLLs ranging from 10 to 52 µg/dl) were identified and investigated by OLPPP. Painting and radiator repair had the largest number of cases of lead poisoning in workers. Among take-home cases, the largest number of children affected had household members in the radiator repair industry.
- As in prior years, many lead poisoning cases were linked to a lack of awareness of lead hazards and how to control them, even in industries where the risks of lead exposure are well known to occupational health professionals. Small businesses in particular have difficulty in setting up a lead safety program and need education and technical assistance.
- Compliance with the BLL testing requirements of the Cal/OSHA lead standards varies by industry but is poor among many industries that use or disturb lead.

Limitations of Registry Data

The data presented in this report are incomplete and do not fully describe the magnitude and distribution of lead poisoning in California industries. The data are incomplete because many employers fail to provide BLL testing to their lead-exposed workers. Published reports and OLPPP's census results indicate that the majority of lead-exposed workers do not receive BLL testing. The result of this large-scale deficiency in testing is that a large proportion of the true number of workers with elevated BLLs will not be captured by the Registry. Additionally, we cannot determine the relative risk of lead poisoning among industries since the proportion of employers testing varies widely by industry. In some industries, the percentage of employers providing testing is so low we have little idea of the prevalence of lead poisoning in those industries.

Registry data are also incomplete because laboratories are not required to report BLLs below 25 µg/dl. Without reporting of all (not just elevated) BLLs, we cannot calculate the proportion of workers with

elevated BLLs, even among those groups of workers being tested, nor can we track the progress of employers in reducing worker exposure to lead, or identify employers who fail to provide required BLL testing.

Improving Tracking of Occupational Lead Poisoning

Improved tracking of occupational lead poisoning will allow OLPPP to better identify problem industries and employers so that we may target them for prevention activities. CDHS is currently pursuing a requirement for the reporting of *all*, not just elevated, BLL test results. OLPPP is working to expand routine BLL testing by educating lead-using industries, unions, and health professionals about the importance of BLL testing and Cal/OSHA's BLL testing requirements. In addition, OLPPP has begun to develop a specific strategy for increasing BLL testing among California's industrial/commercial contractors. OLPPP plans to do similar work in general industry in the future.

Registry Data Guide OLPPP's Prevention Activities

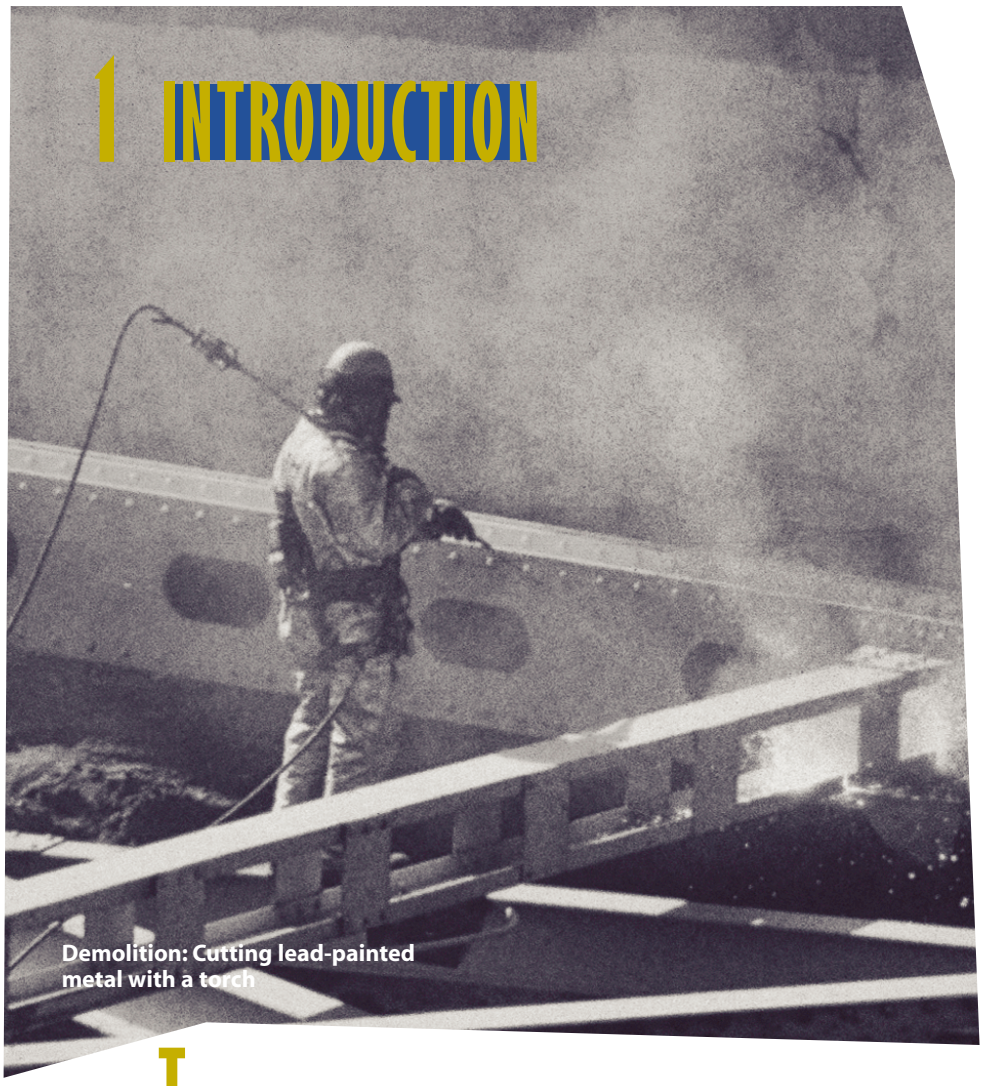
While Registry data do not currently provide us a complete picture of lead poisoning in California industry, they do provide valuable information which guides OLPPP's prevention activities. Since 1995, OLPPP has carried out targeted education and intervention activities in five of the industries identified as high risk by Registry data. The industries are residential painting, industrial/commercial construction, radiator repair, scrap metal recycling, and firing ranges. Individual case investigations also lead to broader efforts to prevent lead poisoning. OLPPP alerted health professionals and employers to the significant risk of lead poisoning in plastics compounding and furniture refinishing after investigating serious lead poisoning cases in these industries.

Conclusion

Despite the limitations of the data, the Occupational Blood Lead Registry provides valuable information on lead poisoning in California workplaces. Registry data indicate that, although it is completely preventable, lead poisoning still occurs on a large scale in California. The problem appears widespread and is not confined to a few industries.

Revisions to the CDHS laboratory reporting requirements will improve our ability to calculate the distribution of BLLs in specific groups of interest and to track employer compliance with Cal/OSHA testing requirements. However, until the majority of employers provide routine BLL testing to their lead-exposed workers, we cannot fully describe the magnitude and distribution of occupational lead poisoning in California. OLPPP will continue its efforts to increase the number of employers doing BLL testing through education and targeted intervention activities. With more complete tracking data we will be better able to identify problem employers and industries and carefully target limited resources to those most in need.

1 INTRODUCTION



Demolition: Cutting lead-painted metal with a torch

The Occupational Lead Poisoning Prevention Program (OLPPP) was established in the CDHS Occupational Health Branch, following the passage of the Occupational Lead Poisoning Prevention Act[1] in 1991. OLPPP is a statewide program aimed at preventing the occurrence of work-related lead poisoning among California workers. OLPPP provides employers with information and technical assistance to control lead exposures; conducts intervention projects in high risk industries; educates workers, employers, and health professionals; investigates severe lead poisoning cases; and maintains the California Occupational Blood Lead Registry.

The California Occupational Blood Lead Registry is a laboratory-based tracking[2] system for lead poisoning that has been in operation since 1987. OLPPP receives, compiles, tabulates, and analyzes the blood lead level (BLL) laboratory reports for adults 16 years and over who are exposed to lead in the workplace. In addition, the Registry also receives and tabulates laboratory reports from non-occupationally exposed adults.

The objectives of the tracking system are threefold: first, to identify serious cases of work-related lead poisoning where follow-up is necessary to ensure proper medical care and control of exposure sources; second, to determine the magnitude and distribution of occupational lead poisoning in California; and third, to provide reliable data for designing and evaluating public health intervention projects in high risk industries.

This report summarizes the Registry findings for the five-year period from January 1, 1995 through December 31, 1999. It also describes the operation of the system, discusses its limitations, and suggests ways to improve tracking of occupational lead poisoning. In addition to lead poisoning, the Occupational Health Branch tracks six other occupational health end points, including asthma, carpal tunnel syndrome, selected fatal and non-fatal injuries, pesticide poisonings, and silicosis.

[1] Health and Safety Code Sections 105185, 105190, 105195.

[2] The term "tracking" is used throughout this report to mean collecting, organizing, and analyzing data about a specific health indicator, in this case blood lead levels. "Tracking" has recently been selected by the Centers for Disease Control and Prevention (CDC) as the preferred term, replacing the earlier term "surveillance."

Background

Exposure to lead has long been known to cause significant health effects in adults, including injury to the nervous system, kidneys, blood-forming, and reproductive systems in men and women.

Damage can occur without any overt signs or symptoms and may be permanent. Exposure to lead can be monitored by measuring the amount of lead in the blood. The results of a BLL test are reported as micrograms of lead per deciliter of whole blood (µg/dl). The BLL reflects the amount of lead currently found in the blood and soft tissues. This may be from recent external exposure as well as from the slow release of any lead stored in bones from past exposures.

There is no known "safe" level of lead in the blood. Recent research continues to show harm to human health at BLLs below 40 µg/dl, including increased blood pressure (Hu, 1996); impaired cognitive abilities, manual dexterity, and muscle strength (Schwartz, 2000; Schwartz, 2001); decreased reaction time (Stollery, 1996); impaired visual-motor coordination (Mantere, 1984); and damaged sperm (Alexander, 1996; Lerda, 1992). In females, lead readily crosses the placenta and is present in breast milk (Abadin, 1997). An elevated risk of spontaneous abortion was found in pregnant women at exposures far lower than encountered in some occupations (Borja-Abuto, 1999).

Lead is associated with harmful effects on children's learning and behavior and the Centers for Disease Control and Prevention (CDC) has established 10 µg/dl as a BLL of concern in children (CDC, 1997). Children under 6 years old as well as the developing fetus are especially sensitive to neurological damage. Impaired cognitive development has been observed in children with prenatal lead exposure (Bellinger, 1987). The persistence of this effect is still uncertain (Bellinger, 1992). Available evidence suggests that there is no BLL without risk of health effects in these populations (National Research Council, 1993). Recent research demonstrated deficits in cognitive and academic skills associated with lead exposure at BLLs lower than 5 µg/dl in children aged 6-16 years (Lanphear, 2000).

Lead has unique chemical and physical properties that have widespread application in general industry and construction. Industries where lead may be found include battery manufacture and recycling; radiator repair; residential, commercial, and industrial painting; firing range operation; nonferrous foundries; and recycling of scrap metal. Lead is encountered in many other industries as well.

Work-related lead poisoning continues to be a serious public health problem. The California Department of Health Services (CDHS) has identified over 100 industries where lead poisoning of workers has been documented. In 1998, the 25 states that required reporting of elevated BLLs to public health officials identified 10,501 adults with BLLs at or above 25 µg/dl (NIOSH, 2000). It is likely that these figures grossly underestimate the extent of work-related lead poisoning in these states. Studies have shown that a low percentage of employers conduct routine blood lead testing of exposed employees (Rudolph, 1990; Papanek, 1992; Nelson, 1998). In the absence of routine BLL testing, many cases of workplace lead poisoning will go undetected.

Occupational Lead Regulations

In 1978, the U.S. Occupational Safety and Health Administration (OSHA) issued a comprehensive standard to protect workers exposed to lead in general industry (29 CFR 1910.1025). In 1993, OSHA issued a similar lead standard for the construction industry (29 CFR 1926.62). California's Division of Occupational Safety and Health (Cal/OSHA) has adopted similar regulations (Title 8 CCR §5198 for general industry; Title 8 CCR §1532.1 for construction). These standards establish airborne exposure limits and require employers to provide exposure assessment and control, training, respiratory protection, hygiene facilities, and a medical surveillance program.

The required medical surveillance[3] program must include periodic blood tests for lead and zinc protoporphyrin (ZPP)[4] for all workers exposed more than 30 days per year at or above an average airborne lead level of 30 micrograms per cubic meter (µg/m^3). Employers must remove an employee from lead exposure when the individual's BLL level is 60 µg/dl or greater;[5] when the individual's average BLL is 50 µg/dl or greater based on three previous BLLs or all BLLs taken in the previous six months, whichever is a longer time period; or when a physician deems it necessary to protect the worker. The employee must remain on medical removal, at a minimum, until two consecutive BLLs are at or below 40 µg/dl. Employers must maintain full earnings, benefits, and seniority of temporarily removed employees. This provision of the standards is called Medical Removal Protection (MRP).

The purpose of the biological monitoring required by the lead standards is to identify individual workers with high exposures; detect early stages of ill health in a worker; ensure that workers at risk receive appropriate medical care and are removed from exposure when warranted; and identify sources of overexposure so that exposure may be reduced.

Using Registry Data for Prevention

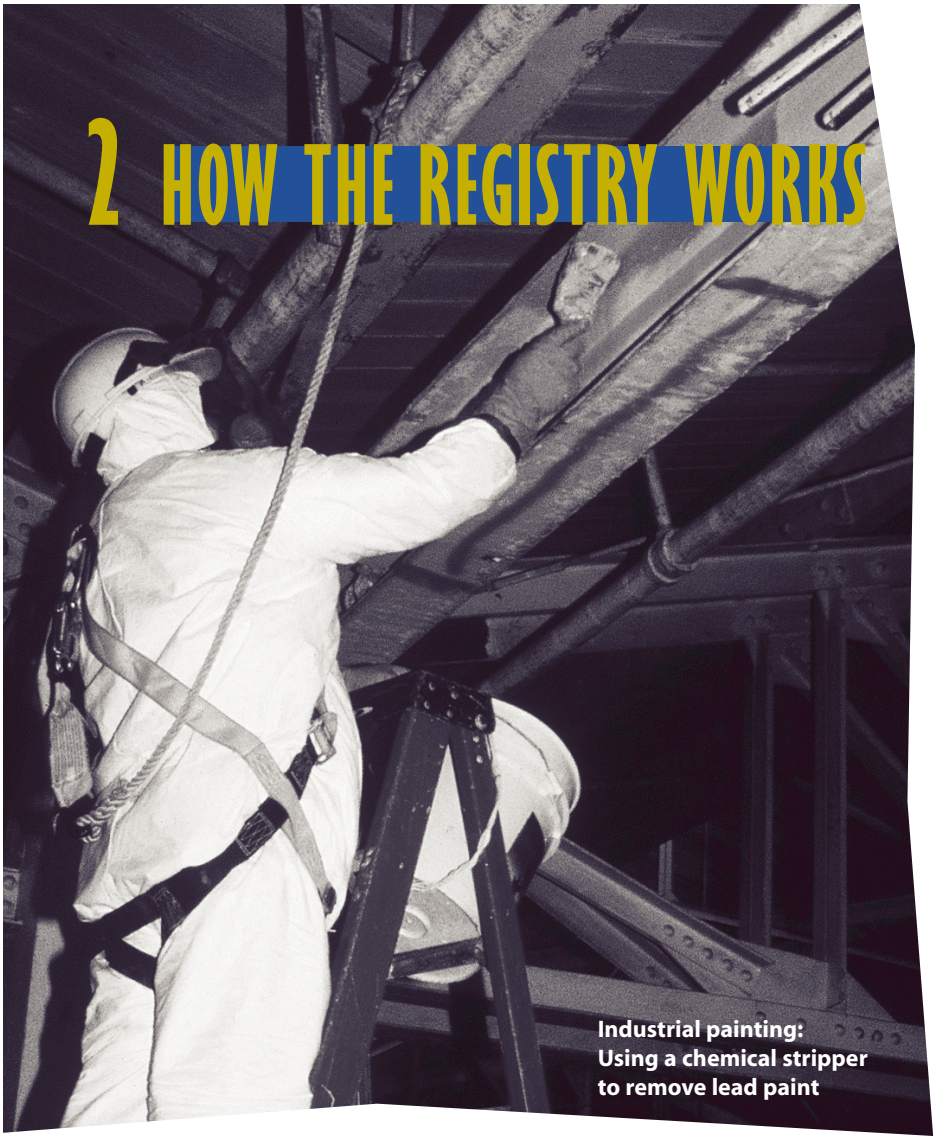
While BLL testing can be highly beneficial to an individual worker, it is of little public health value unless the BLL data are systematically collected, organized, and analyzed. The data can then be used to determine the magnitude and distribution of elevated BLLs among lead-exposed workers, and to design and evaluate prevention and control strategies. The Occupational Blood Lead Registry performs all of these public health functions.

[3] As used by OSHA in the lead standards, the term "surveillance" denotes what is better described as medical "screening" because it focuses on direct examination of individual workers for their benefit.

[4] A ZPP test measures a blood constituent used in making red blood cells. It provides an indication of lead exposure in the 3-4 months preceding the test.

[5] The Construction Lead Standard requires removal at 50 µg/dl.

2 HOW THE REGISTRY WORKS



Industrial painting:
Using a chemical stripper
to remove lead paint

This section provides a brief description of the operation of the Registry and management of individual cases of lead poisoning. (See Figure 1)

Reporting Requirement

In 1986, the California Legislature passed a law that created a laboratory-based tracking system for lead poisoning cases in children and adults (Health and Safety Code, Section 124130). Since January 1, 1987, laboratories performing blood lead analyses on California residents have reported BLLs of 25 µg/dl or greater to the CDHS. CDHS is currently pursuing a requirement for the reporting of *all,* not just elevated, BLLs. In anticipation of the new reporting requirements, most laboratories have begun to voluntarily report levels below 25 µg/dl to CDHS.

Reporting Mechanism

In the current manual reporting system, laboratories report blood sample, patient demographic, and employer information on either a standard CDHS Lead Reporting Form (LRF), or other form that contains the same information as the LRF. (See Appendix A, Sample LRF.) CDHS requests that laboratories report BLLs within 72 hours of analysis.

CDHS has developed software that enables laboratories to report BLLs electronically, thus ensuring that data are transmitted more rapidly and efficiently. Currently, seven laboratories report results to CDHS in electronic format (approximately 27% of total reports received by CDHS), and CDHS is working with another 15 laboratories (both in California and in other states) to begin reporting electronically in the near future. Since electronic reporting is more efficient for CDHS and laboratories, it is our goal that 40-50% of reports will come in electronically by the end of 2002.

Initiation of BLL Testing

Blood lead level tests are initiated by a medical provider. An adult may have a BLL test done as part of an employer-sponsored blood testing program. A personal physician may also order a BLL to provide diagnostic information. Occasionally a BLL test is ordered at the patient's request.

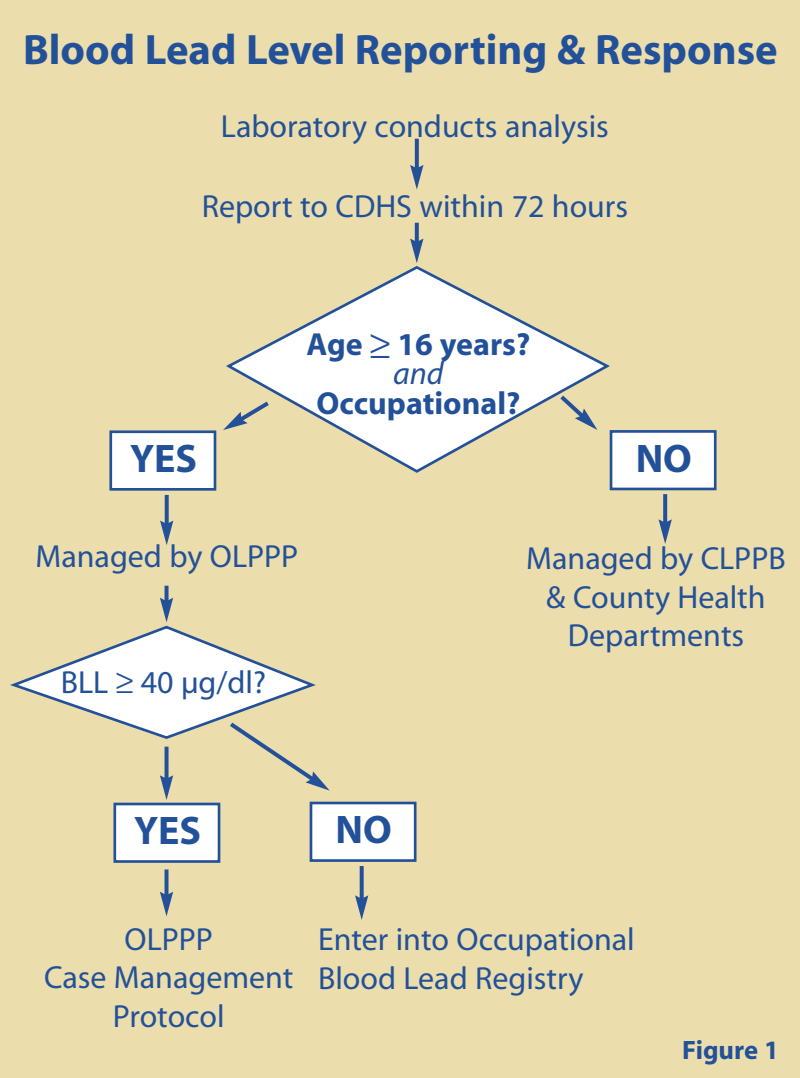


Figure 1

A BLL test performed under the lead standards must be conducted by a laboratory that meets the OSHA requirements for blood lead analysis and is currently listed as an approved laboratory by OSHA.

Data Collection and Processing

The Childhood Lead Poisoning Prevention Branch (CLPPB) in CDHS receives all BLL reporting forms and electronic reports, and forwards reports for individuals 16 years of age and older to OLPPP on a daily basis. OLPPP staff review the incoming hard-copy and electronic reports daily and contact the medical provider or the laboratory to obtain missing patient, employer, physician, sample, and laboratory information. BLLs of 40 µg/dl or higher are verified for occupational exposure and referred immediately to the OLPPP case management team for follow-up (discussed in more detail below). Reports for non-occupational adult cases, regardless of blood lead level, are forwarded to CLPPB for referral to the county health department. (See Figure 1.) Reports for workers residing or working outside California are forwarded to the appropriate state health department for follow-up. (***Note: if a worker either resides or works in California, OLPPP does the usual follow-up for these cases based on the BLL.***)

OLPPP has developed a customized relational database system to enter and manage BLL data (Elevated Lead Visual Information System, or ELVIS). Patients, employers, and physicians are assigned a unique identifying number, which allows information collected from different sources at different times to be linked. Each employer is also assigned a four-digit Standard Industrial Classification (SIC) code.[6] For employers with BLL reports of 25 µg/dl or greater, SIC codes are assigned based on information gathered by OLPPP staff in telephone interviews with the employers. SIC codes assigned by interview are reviewed by OLPPP's industrial hygienist to ensure consistency in coding. Employers with all BLL reports below 25 µg/dl are not interviewed. A commercial marketing database is used to assign an SIC code to these employers.

[6] Standard Industrial Classification Manual 1987. Executive Office of the President, Office of Management and Budget.

Quality Control

The ELVIS database has many built-in features that ensure that data are entered correctly – e.g., that our data accurately track specific workers' BLLs, and attribute these BLLs to the correct workplace and type of exposure. At the time of data entry, ELVIS automatically runs quality control programs to ensure that blood lead results, workers, or employers are not double-entered, and to flag for review and correction other erroneous entries that may occur. For example, upon entry of new results, ELVIS checks for dates that are out of sequence (e.g., an analysis date before the blood draw date). In addition to data-checking that is performed at the time results are entered, detailed quality-control programs are run periodically. These periodic programs check and flag for review potential data entry errors that may have been missed by the quality control performed when results were initially entered. For example, periodic quality control looks for possible reversed first and last names and single results tagged as "unknown employer" for workers who have multiple BLL results with a known employer.

Confidentiality

OLPPP uses several methods to protect the confidentiality of data reported to the Registry. First, ELVIS is maintained on a secure network that allows access to the data only by specific OLPPP personnel. Secondly, the LRFs and other data forms are kept in locked filing cabinets, within a secure (key-card entry access) office suite. Finally, OLPPP does not release data containing personal, employer, or physician identifying information to persons outside OLPPP except when required to by legal subpoena, or as necessary to a treating physician or local health department to ensure appropriate treatment and follow-up of a lead-poisoned individual, or when necessary to assist another agency to carry out its enforcement functions. Aggregate data are available upon written request to OLPPP.

Case Management

OLPPP's case management team initiates intensive follow-up efforts if a worker has a BLL of 60 µg/dl or greater, or when a local health department suspects that a child has been poisoned by lead brought home from a workplace. OLPPP defines a case as take-home lead exposure when the following criteria are met: 1) a child or other household member has a BLL of 10 µg/dl or greater; 2) an adult worker in the household has a BLL of 10 µg/dl or greater; and 3) a source of lead in the workplace has been confirmed.

Case management staff contact the worker, employer, and physician by phone and interview each using standardized questionnaires. OLPPP has bilingual staff who interview individuals in Spanish when necessary. If the worker's BLL is less than 80 µg/dl and the test was not sponsored by the employer, OLPPP obtains the worker's consent prior to contacting the employer. If the BLL is at or above 80 µg/dl, the worker's consent to contact the employer is not required. BLLs at or above 80 µg/dl are considered medical emergencies. In these situations, OLPPP has an overriding responsibility to intervene to ensure that other workers are not poisoned.

Workers are contacted by telephone in order to address their concerns about the BLL, find out more about the workplace and work practices, and to identify household members and co-workers at risk. Workers are sent a letter and educational materials including a lead safety video. Educational materials are available in English and Spanish.

The employer is contacted to review the company's lead safety measures, identify the conditions that led to the overexposure, and to provide technical assistance in addressing those hazards. Each employer receives a packet of written material, an educational video, and a detailed letter specifying recommendations with a timeline for improvements. On occasion, OLPPP staff will conduct an on-site investigation. Employers who need on-site assistance are referred to the Cal/OSHA

OLPPP Case Management Protocol

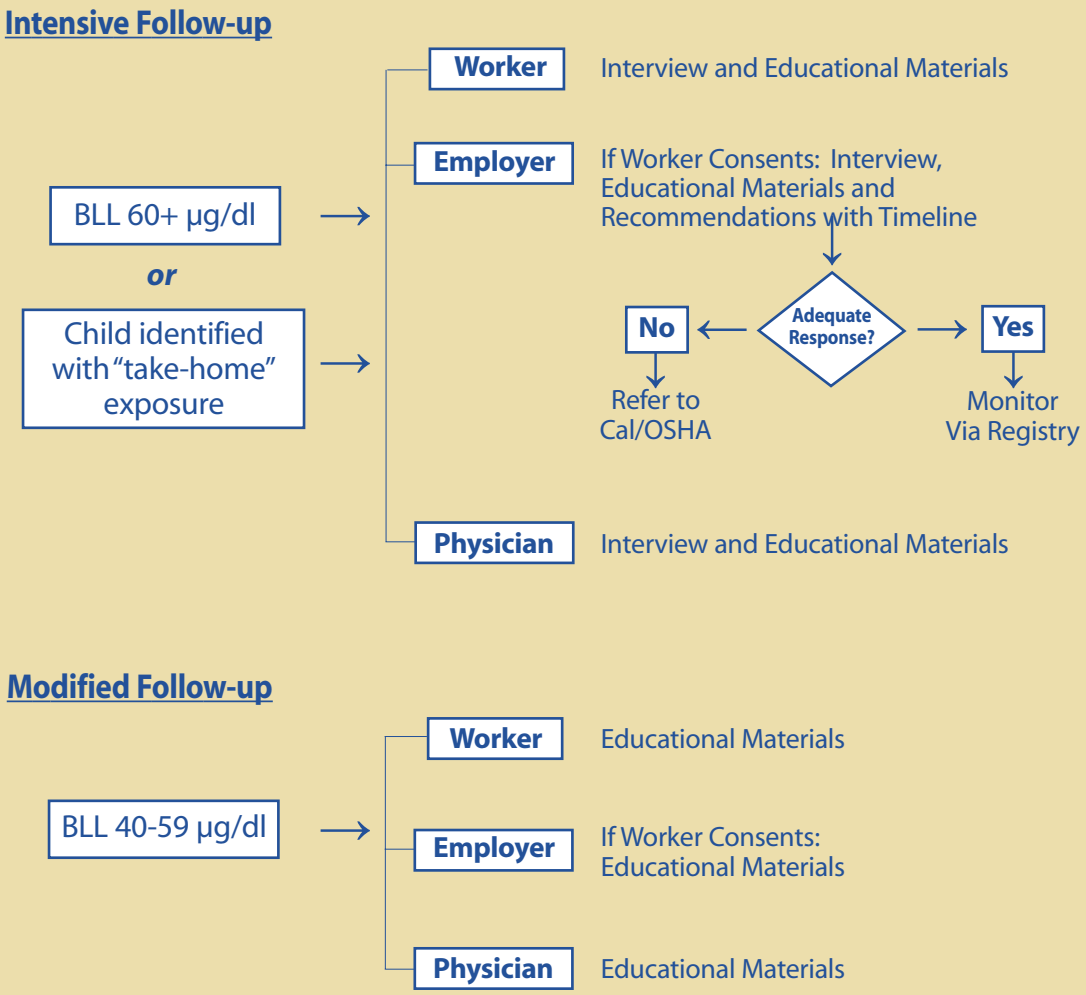


Figure 2

Consultation Service and their workers' compensation carrier. Employers who do not correct serious health and safety hazards may be referred to Cal/OSHA Compliance for enforcement action. Figure 2 shows the flow of case management followed by OLPPP for serious worker (60 µg/dl or greater) and take-home lead poisoning cases.

OLPPP's medical staff contact the physician involved to ensure that the poisoned worker is receiving appropriate care. Physicians who are the health care provider for the employer (in a stated or unstated contractual agreement) are provided information about their duties to the employer and the workers under the lead standards.

OLPPP conducts a modified follow-up of workers with BLLs between 40 and 59 µg/dl (see Figure 2). Workers receive a letter, video, and educational materials on the health effects of lead, how lead poisoning can be prevented, take-home exposure, employer health and safety responsibilities, and workers' legal rights. If the blood test was not done as part of an employer-sponsored medical program, OLPPP requests the worker's consent before sending a similar letter and packet of educational materials to the employer. All physicians receive educational materials as well.

Since 1999, OLPPP has been mailing each of the county Childhood Lead Programs a monthly printout of workers with BLLs between 25 and 39 µg/dl. This enables counties to follow up on possible take-home exposure cases in children of workers. Follow-up activities by the counties are voluntary and not required by either OLPPP or the CLPPB.

Data Analysis

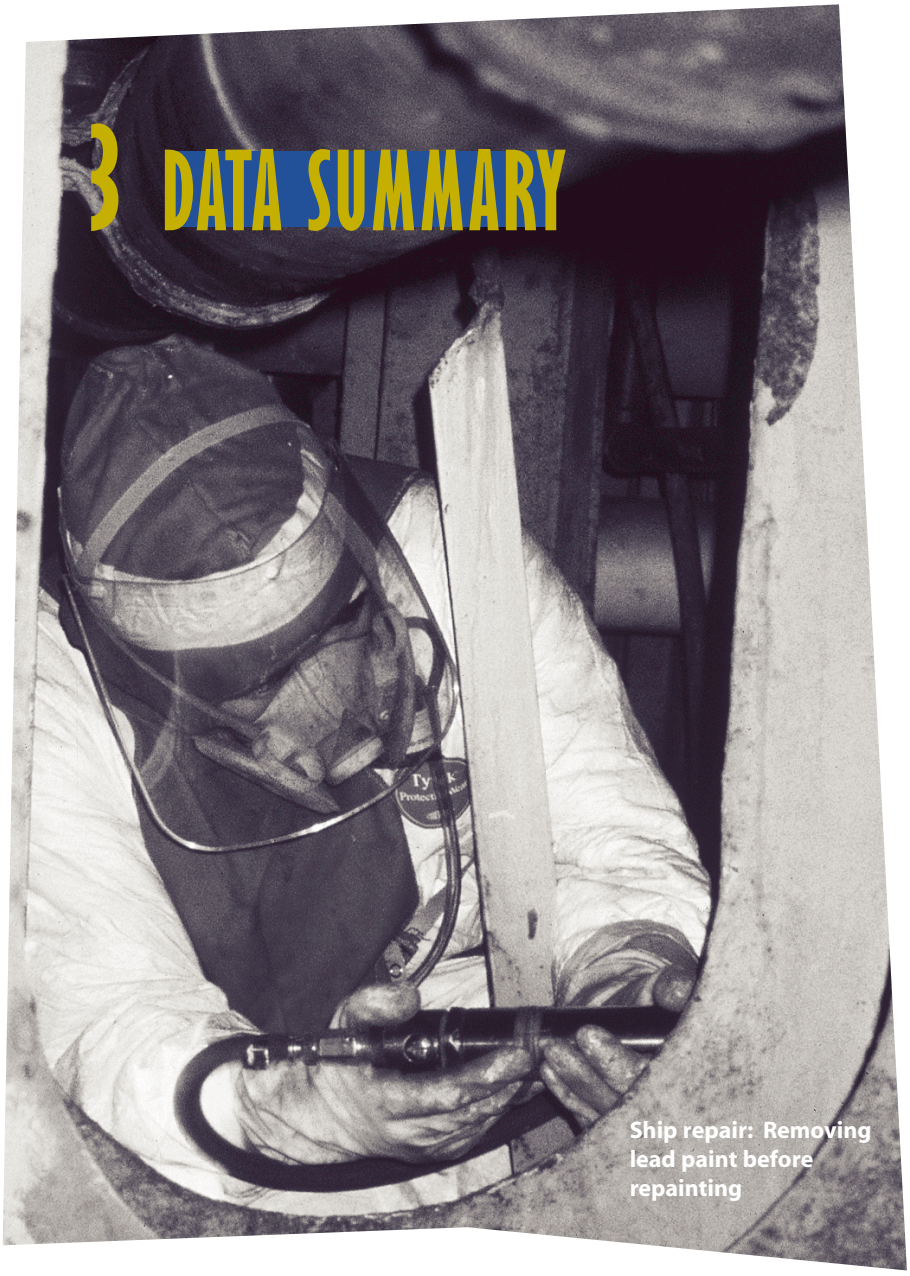
Data are tabulated and aggregated by demographic categories. An abbreviated data summary, which presents the number of reports and individuals by BLL level, is prepared quarterly; no personal identifiers are included. OLPPP also periodically prepares a full report, *Blood Lead Levels in California Workers: Report of the California Occupational Blood Lead Registry*, which summarizes BLL tracking data, and includes demographic information, BLLs by industry, and a discussion of findings.

Dissemination of Data

Quarterly data summaries are forwarded to the National Institute of Occupational Safety and Health (NIOSH). NIOSH compiles quarterly reports from all states that require reporting of BLLs and publishes summary data periodically in the *Morbidity and Mortality Weekly Report* (MMWR). The MMWR is distributed widely to health care and public health professionals throughout the U.S.

OLPPP's periodic report *Blood Lead Levels in California Workers* is distributed to laboratories, employers and physicians reported to the Registry, county Childhood Lead Programs, and other states' Adult Blood Lead Epidemiology and Surveillance (ABLES) programs. The report is also made available to companies who pay the lead poisoning prevention fees that support OLPPP. It is posted on the OLPPP website at www.dhs.ca.gov/ohb.

3 DATA SUMMARY



Ship repair: Removing lead paint before repainting

BLOOD LEAD LEVELS

Between January 1, 1995 and December 31, 1999, OLPPP received 47,906 blood lead level reports for individuals aged 16 and over. After investigation, we determined that a total of 46,525 of these reports were for individuals occupationally exposed to lead.[7] Because many workers are tested several times each year, the number of reports exceeds the number of individuals in the Registry; during this five-year period the total number of individual workers reported to the Registry was 17,775. These individuals were employed by 1,030 different employers. See Appendix B, Table 1 for details.

Distribution of Blood Lead Levels

The level of lead in the blood is a direct index of worker exposure as well as an indication of the potential for adverse effects on health. Low exposures that in the past were thought safe are now considered hazardous as new information emerges about the toxicity of lead.

The General Industry Lead Standard requires medical removal when a worker has a BLL of 60 µg/dl or greater, or has an average BLL of 50 µg/dl on the last three tests. The Construction Standard requires removal when the BLL reaches 50 µg/dl. However, serious damage to the neurological, reproductive, and blood-forming systems can occur below these levels. There is growing evidence of harm to human health at levels below 40 µg/dl including increased blood pressure, brain and nerve damage, sperm abnormalities, and impaired learning ability in children who were exposed to lead during gestation. For comparison, the average BLL of adults in the United States is less than 2 µg/dl (CDC, 2001).

Of the 17,775 workers reported to the Registry during the five-year period 1995 through 1999, 2,657 workers had a peak blood lead level at or above 25 µg/dl; 557 workers had a peak BLL at or above 40 µg/dl and may have suffered serious damage to

[7] Results are assumed to arise from occupational lead exposure, unless known otherwise. We do not attempt to find out whether exposure is occupational or non-occupational if the BLL is less than 25 µg/dl.

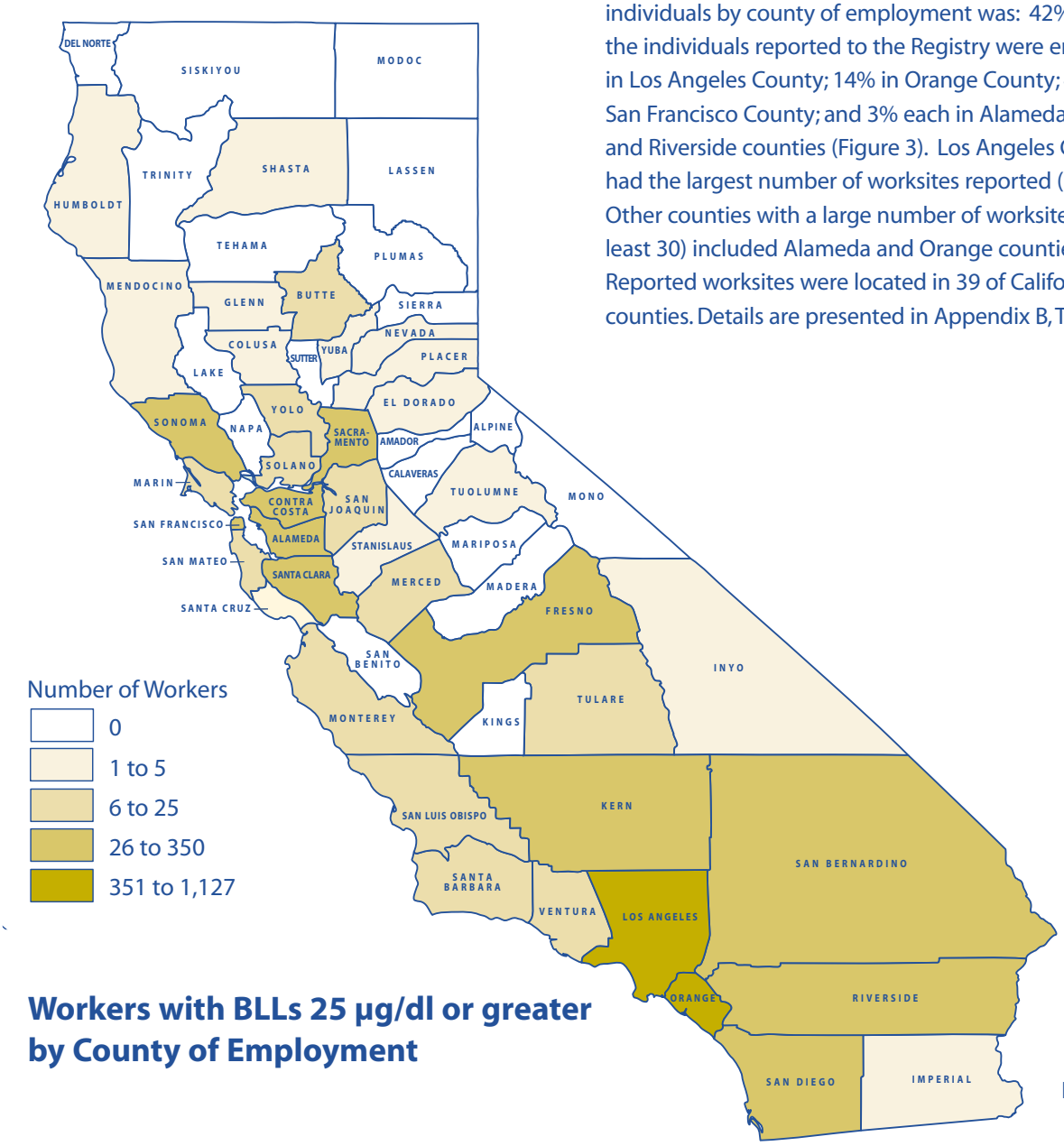
their health as a result of these overexposures. BLLs ranged up to a high of 221 µg/dl.

BLL distributions by year are presented in Appendix B, Table 2. During the five-year period 1995-99, the proportion of BLLs in the categories of 60 µg/dl and above, 50-59 µg/dl, and 40-49 µg/dl decreased slightly, while the proportion of BLLs in the 25-39 µg/dl category increased from 80% to 87%.

NOTE: Individuals with a peak BLL below 25 µg/dl were removed prior to developing the distributions for the remainder of this report because not all laboratories report BLLs between 1 and 24 µg/dl.

County of Employment

The 1995 through 1999 distribution of individuals by county of employment was: 42% of the individuals reported to the Registry were employed in Los Angeles County; 14% in Orange County; 4% in San Francisco County; and 3% each in Alameda, Fresno, and Riverside counties (Figure 3). Los Angeles County had the largest number of worksites reported (158). Other counties with a large number of worksites (at least 30) included Alameda and Orange counties. Reported worksites were located in 39 of California's 58 counties. Details are presented in Appendix B, Table 3.



Workers with BLLs 25 µg/dl or greater by County of Employment

Figure 3

Gender and Age Distribution

The overwhelming majority of workers reported to the Registry from 1995 through 1999 were male (94%). The age distribution was typical for a working population; most of the workers were between 20 and 59 years of age (95%) (Appendix B, Table 4).

Racial and Ethnic Distribution

Although laboratories are requested to report the patient's race (white, black, Asian, other), this information is rarely provided. Therefore, it is not possible to describe the racial distribution of workers in the Registry.

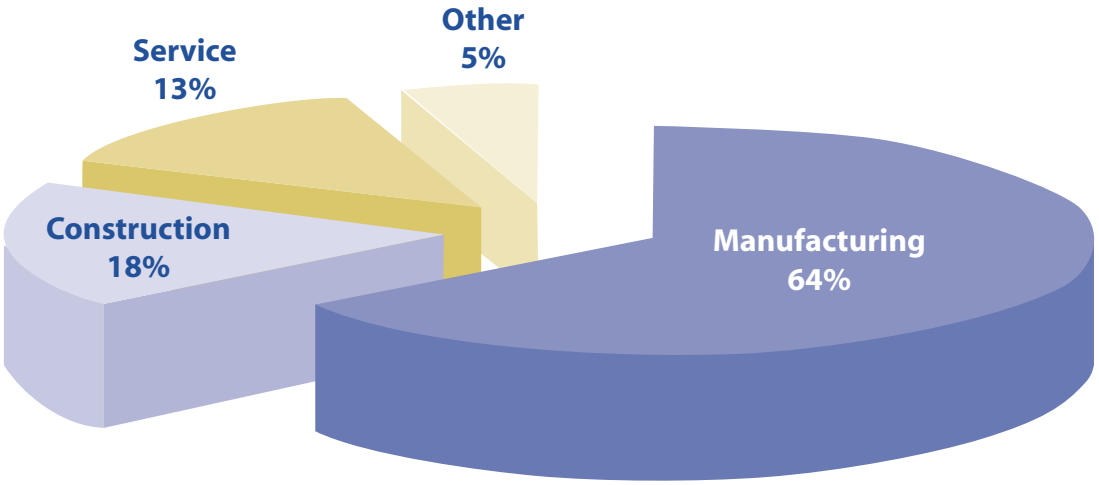
The racial/ethnic description of Registry data is limited to the identification of persons with Spanish surnames as a surrogate for Hispanic ethnicity. Surnames of persons reported to the Registry are compared to the U.S. Bureau of the Census list of Spanish surnames (U.S. Department of Commerce, 1980). The majority of persons reported to the Registry had Spanish surnames (52%) (Appendix B, Table 4). For comparison, 28% of the California workforce is Hispanic (U.S. Department of Labor, 2001).

Industry Sector

The majority of persons reported to the Registry in 1995-99 with elevated BLLs (25 µg/dl or greater) worked in manufacturing (64%), including storage battery manufacture, nonferrous secondary smelters, and manufacture of non-tableware pottery products. Individuals were also employed in construction (18%) and service industries (13%). (See Figure 4.) Construction industries include wrecking and demolition, masonry (furnaces in lead smelters), and painting. Included in the service industries are radiator repair shops and firing ranges. Six of the 14 workers listed in retail trade (i.e., all workers with BLLs 50 µg/dl or greater) came from a single employer, a sporting goods store whose employees were exposed to high levels of lead while demolishing an old firing range. (See Appendix B, Table 5 for BLL distributions by industry sector.)

Specific Industry

Among the workers with elevated BLLs reported in 1995 through 1999, the ten specific industries with the largest number of individuals reported are shown



Percent of BLLs 25 µg/dl or greater by Industry Sector

Figure 4

Top Ten Industries with Largest Number of Workers Reported with BLLs 25 µg/dl or greater, 1995 -1999

1. Storage Battery Manufacturing
2. Nonferrous Secondary Smelting
3. Radiator Repair
4. Painting
5. Copper/Brass Foundries
6. Masonry
7. Firing Ranges
8. Scrap Metal Recycling
9. Pottery Manufacture
10. Wrecking and Demolition

Figure 5

in Figure 5. Table 6 in Appendix B shows the BLL distributions by specific industry for all workers reported in the period 1995 through 1999 with BLLs of 25 µg/dl or greater.

Battery Manufacturing and Battery Recycling Industries

The potential for serious lead exposure and lead poisoning in the lead-acid battery manufacturing and recycling industries is well-known and periodic blood lead testing is common among employers in these industries. Seventy percent (70%) of the occupational BLL reports we received during the period 1995-1999 came from the battery industries. Over 95% of lead-exposed workers in these industries in California are part of a blood lead testing program. We receive all blood lead test results, regardless of level, for almost all the battery manufacturing and recycling workers in the State. There is no other industry in California for which we have such complete data.

The availability of BLL data on nearly all battery workers gives us an accurate picture of the incidence of lead poisoning in these industries. In addition, with nearly complete BLL data at the lower levels (1-24 µg/dl) we can look at changes in the distribution of blood lead levels in these industries over the five year period 1995-1999 (See Appendix B, Table 7). After 1995 there were no reports of workers with BLLs at or above 60 µg/dl. Additionally, over the 5-year period, the percentage of BLLs at the lower end of the distribution increased and the percentage of reports at the higher end decreased. These data indicate that the battery industries have made progress in reducing worker exposure to lead. Still, the hundreds of individuals with elevated BLLs (25 µg/dl or greater) indicate that additional effort is needed to reduce lead exposure in these industries.

Non-Occupational Reports

During the period 1995-1999, we received BLL reports for 265 adults whose lead exposure we determined was non-occupational. Most of these reports were identified as non-occupational when we called a medical provider to complete employer information on reports 25 µg/dl or greater. In a few cases, the lead source was identified as non-occupational on the LRF. BLLs ranged up to 273 µg/dl. Sixty-nine percent were male and 31% female; 36% had Spanish surnames. For 156 of the 265 individuals we know the specific lead exposure source (See Table 8 for BLL distributions by source). The most frequent reported sources of non-occupational lead exposure were retained bullets, target shooting, and pica.[8]

All reports of individuals that are found to be non-occupational are referred for follow-up to the Childhood Lead Program in the county in which the individual resides. Follow-up often includes referral to a health practitioner who specializes in lead, testing of other family members, and inspection of the home environment for possible sources of lead.

[8] An abnormal craving to eat nonfood items such as clay or paint.

SYSTEM OPERATION

Reporting Sources

OLPPP receives blood lead test results from laboratories located in California as well as laboratories in other states. For the period from 1995 through 1999, the majority of reports received by OLPPP (70%) were analyzed by laboratories in other states, while 30% of reports were analyzed by California laboratories.

Timeliness

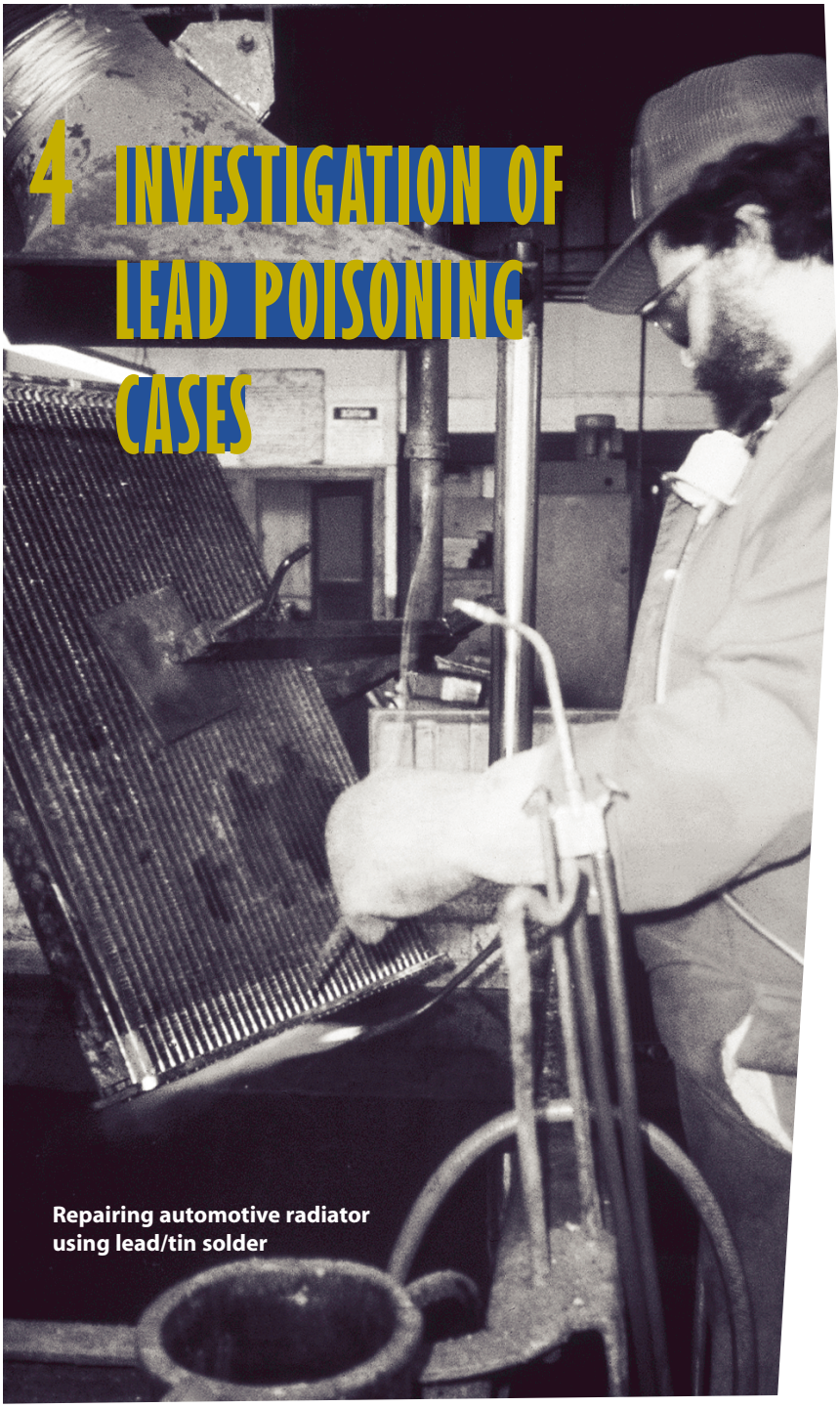
CDHS requests that laboratories report blood lead results to the Department within 72 hours of analysis in order to ensure adequate and timely follow-up of serious cases of lead poisoning. Very few laboratories, however, report blood lead results that rapidly. Laboratories within California generally report results more quickly, in part because out-of-state laboratories tend to group reports and forward them to CDHS in bunches rather than individually. For the period from 1995 through 1999, 10% of reports were received from California labs more than one month after analysis; 22% of reports from out-of-state labs were received more than one month after analysis. Only 14% of reports from California labs and 2% of reports from out-of-state labs were received within the requested 72 hours.

Completeness

We estimate that one quarter to one third of the reports received by OLPPP did not contain complete information on patient demographics or employer. In these situations OLPPP staff had to contact the reporting laboratory and/or requesting provider (or employer) in order to obtain missing information.

With extensive effort, we were able to obtain a significant percentage of the missing information. We had information on gender for nearly 100% of the individuals reported. Information on age was 95% complete. We had information on employer and worksite location for 85% of individuals reported to the Registry, and information on county of residence for 90% of the workers reported to the Registry.

4 INVESTIGATION OF LEAD POISONING CASES



Repairing automotive radiator using lead/tin solder

During the period 1995 through 1999, 39 workers had one or more BLL reports at or above 60 µg/dl, meeting OLPPP's criteria for intensive follow-up (Appendix B, Table 9).[9] We investigated each of these new cases of lead poisoning (representing 30 employers) and made specific recommendations for correcting the working conditions that had resulted in a worker becoming lead poisoned. In addition, we investigated 41 cases of take-home lead poisoning (representing 25 employers). Forty of these cases were children and one was an adult household member (Appendix B, Table 10). OLPPP referred nine employers to Cal/OSHA for failing to comply with our recommendations. These employers included two radiator repair shops, two firing ranges, two battery manufacturing plants, a battery recycler, a lead oxide plant, and a fishing weight manufacturer.

The segment of industry reporting the greatest percentage of serious worker lead poisoning cases was construction (33%), followed by service industry (28%) and manufacturing (26%). Radiator repair shops (classified as service industry) had the largest number of reported cases (9 cases representing 7 employers). Eight cases were reported among painting companies.

Among take-home cases, the largest number of children affected had household members in the radiator repair industry (13 cases), followed by sporting goods stores (10 take-home cases resulted from employees of a retail gun shop given the task of demolishing an old firing range).

Sample Case Investigations

Six examples of 1995-99 case investigations are described below. Three are from general industry, three are from construction; two also involved take-home exposure to family members.

[9] We initiated case investigations for 39 of the 43 workers reported with BLLs 60 µg/dl or greater. One worker was unable to be contacted, two were already under investigation, and the fourth worker's result was determined to be a lab error.

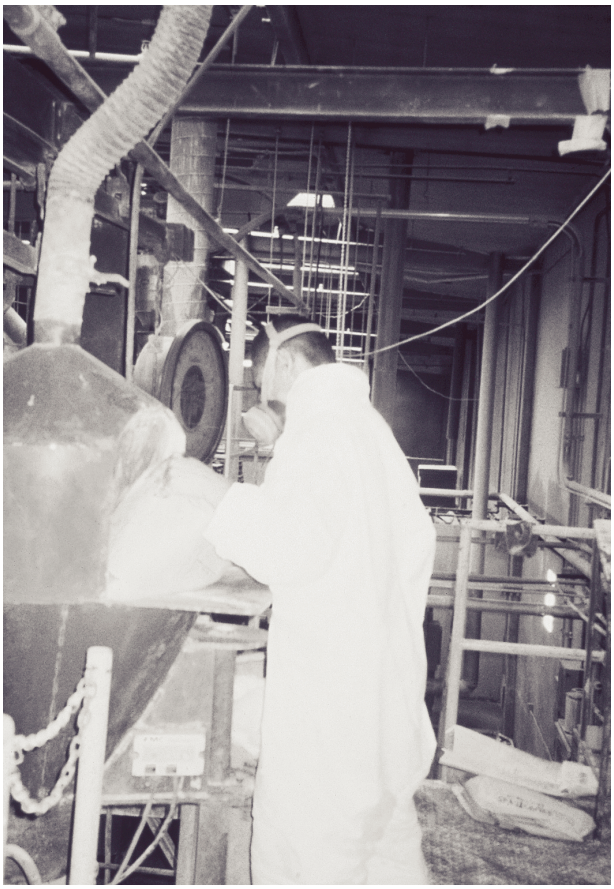
GENERAL INDUSTRY:
PLASTICS COMPOUNDER

What happened?

A worker at a plastics compounding company saw his personal doctor many times over two years for symptoms of abdominal pain, fatigue, decreased appetite, and constipation. He was diagnosed with gastritis and treated unsuccessfully. After noticing the word "lead" printed on the bags of powder he worked with, the worker asked his doctor for a BLL test. His BLL was 164 µg/dl. Testing of his eight co-workers identified two more workers with severe lead poisoning (114 µg/dl, 108 µg/dl). All three workers were removed from exposure and treated by an occupational medicine physician.

The worker's job was to scoop 6-8 pounds of pure lead sulfate powder from a bag into a large mixing vat while wearing only a paper dust mask. Lead sulfate is used as a stabilizer in plastics used for electrical devices. The product Material Safety Data Sheet (MSDS) did not mention the serious health effects of lead, and only recommended that a respirator be used for "fine dust." The employer had interpreted this to mean a dust mask. No lead safety program was in place and the workers had never been BLL tested.

The employer worked cooperatively with OLPPP to set up a lead safety program. He switched to a pre-packaged stabilizer in a dissolvable package that was added intact to the plastics mixture to reduce exposure. Ultimately, he adopted a lead-free stabilizer.



Plastics compounding: Adding lead stabilizer to batch

What was learned?

- There is a potential for serious overexposure to lead in the compounding of plastics for use in electrical products.
- It is critical that medical providers ask patients about occupation and order a blood lead test if lead exposure is suspected.
- MSDS quality varies and practitioners, employers, and workers should seek additional health and safety information from other sources, including OSHA and state health departments.

GENERAL INDUSTRY:
SCRAP METAL COMPANY

What happened?

A scrap metal recycling worker was identified with a BLL of 60 µg/dl. He had been sent to a demolition site to torch cut lead-painted steel while wearing a disposable mask. He had multiple symptoms of lead poisoning and was medically removed from working with lead.

Another worker at the same company received and sorted scrap in the company yard, as well as melted metal with a torch and poured it into an ingot. He wore no respirator. He went to his personal doctor suffering from headache, dizziness, digestive problems, nervousness, irritability, and weakness. His BLL was 29 µg/dl. He was diagnosed with lead poisoning and removed from lead work.

After the lead poisonings were discovered, the company did air monitoring, which showed levels above the Cal/OSHA Permissible Exposure Limit (PEL). The company's lead safety program was also deficient in many areas. The workers' doctor referred the company to Cal/OSHA after it failed to comply with OLPPP's recommendations. Cal/OSHA gave the company a hefty fine.

Scrap metal: Cutting an industrial radiator that has lead solder

What was learned?

- Sources of lead in a scrap metal operation need to be identified and airborne lead levels measured. These are the first steps toward protecting employee health.
- A worker who has lead poisoning symptoms can be placed on medical removal protection (MRP) by a physician even if his BLL is below 50 µg/dl.
- Scrap metal workers may have exposure to lead and other toxic metals both on site and while doing demolition off site. They need to be fully protected in all settings.

CONSTRUCTION:
DEMOLITION OF FIRING RANGE

What happened?

A day laborer requested a BLL test his third day on a firing range demolition job when he went to the emergency room for a work-related injury. The workers had not been told lead was present on the job, had no protections for work with lead, and wore their work clothes home. The worker's BLL of 74 µg/dl prompted further investigation. Four other workers were tested and had BLLs ranging from 57 to 98 µg/dl; none of the workers had been on the job longer than 2-1/2 weeks. None reported prior work with lead.

The county Childhood Lead Program's public health nurse contacted the workers' families. Blood lead testing identified nine children of three workers, ranging in age from 18 months to 12 years, with BLLs of 13 to 34 µg/dl. The 18-month old child had the highest BLL. The wife of one of the workers, who hand-washed her husband's work clothes, reported symptoms similar to his. Her BLL was 36 µg/dl.

OLPPP, in collaboration with the local health department, worked with the employer, physician, and workers to address worker and family lead exposure issues and ensure safe environmental cleanup of the highly contaminated demolition site and the workers' homes.

What was learned?

- Blood lead levels can rise rapidly. The worker's BLL was 74 µg/dl after only 3 days on the job.
- Children and family members can be poisoned by lead dust taken home on a worker's clothing, shoes, and body.
- County Childhood Lead Programs play an important role in identifying family members poisoned by take-home lead and ensuring that contaminated homes are cleaned up.

GENERAL INDUSTRY:
HOME-BASED CERAMICS

What happened?

A child was tested for lead as part of her pre-kindergarten exam. Her BLL was 21 µg/dl, above the Centers for Disease Control and Prevention's (CDC) level of concern of 10 µg/dl for children. The girl's mother and grandmother operated a full-time business out of their home painting ceramic tiles with lead-based paints. They were tested and had BLLs of 44 and 45 µg/dl.

The grandmother was reluctant to change to lead-free paint for fear that her primary customer would find the product unacceptable. She was also reluctant to accept that the lead paint was the main source of poisoning. The county environmental health specialist tested her home for other lead sources in house paint, water, and soil. The only source was the lead-based ceramic tile paint. After many months of follow-up by OLPPP and many visits and phone calls by the county Childhood Lead Program, the grandmother substituted lead-free tile paint and decontaminated her home.

What was learned?

- Testing a child's BLL may lead to discovery of a take-home case of lead poisoning. It is important for pediatricians to ask parents what kind of work they do.
- A home-based business can lead to 24-hour exposure of the worker and family members, as well as contamination of the home.
- When lead is used in a home-based business, the exposed owner/operator may be very reluctant to make changes for fear of losing their only income.

CONSTRUCTION:
BRIDGE PAINTING COMPANY

What happened?

OLPPP heard from an occupational medicine physician who was treating a seriously lead poisoned employee of an industrial painting company. Company-provided BLL testing showed that this worker's BLL increased from 7 to 134 µg/dl in approximately two months. The employee was immediately removed from work with lead. His BLL increased on follow-up tests over the next few days to 221 µg/dl. The worker was treated with a chelation drug to remove the dangerous levels of lead and followed closely by the physician.

For six weeks prior to the high BLL, the worker had been abrasive blasting off sections of paint with a vacuum-attached tool on a major bridge undergoing seismic retrofit. He stated that the company told him to wear a half-mask respirator for this work (the company disputed this). In the absence of air monitoring data showing lower air lead levels, the appropriate respirator would be supplied-air. The company's one relevant air monitoring result (2,300 $\mu g/m^3$) supported the need for supplied-air respirators.

Cal/OSHA inspected this job due to an enforcement emphasis program on lead in construction work. Cal/OSHA cited the company for several deficiencies including failure to ensure use of appropriate respiratory protection.

Industrial painting: Abrasive blasting in containment

What was learned?

- Abrasive blasting lead paint on steel structures often causes extremely high air lead levels, and usually calls for supplied-air respirators unless lower air levels are well documented.
- Frequent (at least monthly) blood lead testing is needed on abrasive blasting jobs to detect failures in protection before workers are seriously lead poisoned. If BLLs are rising, controls need to be re-evaluated.
- Close supervision is needed in high-exposure construction work to ensure that all aspects of the company's lead safety plan, including correct respirator selection, are executed consistently.

CONSTRUCTION:
RESIDENTIAL PAINTING COMPANY

What happened?

A self-employed house painter worked for about ten days on the exterior of an 1898 Victorian house, preparing the surface by water blasting, hand scraping, and power sanding to remove old paint. For protection he wore only a paper dust mask. He smoked on the job and did not always wash up before smoking or taking breaks. He also wore home the clothes and shoes he worked in.

The painter went to his doctor because he was having chest pain and occasional dizziness, and he also asked for a blood lead test. His BLL result was 76 µg/dl.

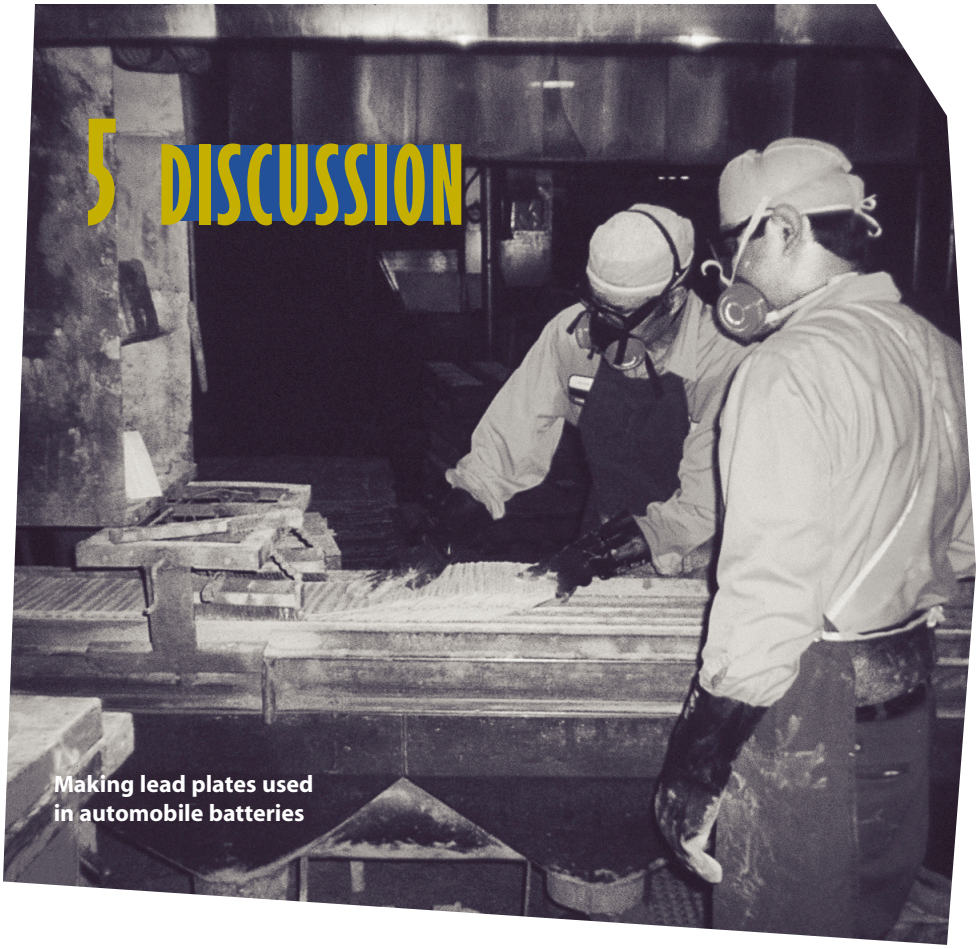
OLPPP provided the painter with information on how to do lead-safe painting work. Then, because the worker had finished the lead-disturbing work on this job, OLPPP focused on testing others at risk and cleaning up the lead contamination created by the work. The painter's family members and the homeowner's children were tested; fortunately none had elevated BLLs. The painter and homeowner did a thorough cleanup of the home, inside and out, to ensure that lead dust and paint chips were removed.

Residential painting: Scraping lead paint

What was learned?

- House painters doing dry hand scraping and power sanding of old lead paint without proper protections can become seriously lead poisoned in a short amount of time.
- Steps must be taken on painting jobs to keep lead dust contained in the immediate work area and clean it up using safe methods, in order to prevent contamination of the property.
- Painters need specific lead safety training so they know how to do the work in a way that does not endanger themselves, their family members, and building occupants.

5 DISCUSSION



Making lead plates used in automobile batteries

Work-Related Lead Poisoning is Still a Problem

Lead poisoning persists as a serious occupational health problem in California 23 years after adoption of a comprehensive general industry lead standard by the Occupational Safety and Health Administration (OSHA). Despite widespread failure of employers to conduct routine BLL testing of lead-exposed employees, OLPPP received thousands of reports of elevated BLLs (25 µg/dl or greater) in workers during the five-year period covered by this report (2,657 individuals). The overwhelming majority of individuals reported to the Registry were male, with an age range typical of a working population (95% between 20 and 59 years of age). Individuals with Spanish surnames were disproportionately represented; California's workforce is 28% Hispanic, whereas the proportion of Spanish surnames among individuals reported to the Registry between 1995 and 1999 was 52%. A large portion (42%) of workers with BLLs 25 µg/dl or higher were employed in Los Angeles County. This reflects the concentration of California lead industries in this county.

Reports of BLLs 25 µg/dl or greater were not confined to just a few industries; 117 unique four-digit SIC codes were assigned to employers during the period 1995-1999. All ten of the "Top Ten" industries with the largest number of workers reported with elevated BLLs were also on the list in 1993 or in 1994; in fact, the top three of these remained in the same order (battery manufacturing, secondary nonferrous smelters, and radiator repair). Thirty-two percent of the workers identified with BLLs 25 µg/dl or greater[10] during this five-year period worked in battery manufacturing plants. Large numbers also worked in secondary nonferrous smelters and battery recycling plants (10%) and automotive radiator repair shops (9%). Eighteen percent of all workers identified with BLLs 25 µg/dl or greater were employed in the construction trades; however, construction workers made up a disproportionate number of reported serious lead poisoning cases (60 µg/dl or greater) with 13 of the total 39 cases (33%).

It is not possible to draw conclusions from these data about the relative risk of lead poisoning in these industries compared to other lead-using industries since so few employers do routine BLL testing. These data do show, however, that the problem is widespread and that it persists in industries in which historically lead poisoning has occurred and where lead hazards are widely known.

[10] Two hundred forty-nine (249) workers with unknown industry were excluded from the total 2,657 workers.

Lead Poisoning is Caused by Many Factors

During the five-year period 1995-99, OLPPP investigated 39 cases of workers with BLLs of 60 µg/dl or greater. Some of these serious cases of lead poisoning were uncovered only when the worker's personal physician tested him for lead, rather than as part of a company lead medical program. Extremely high BLLs were found in a worker abrasive blasting paint off a bridge (221 µg/dl) and in several workers compounding plastic resins (108 –164 µg/dl). Two industrial processes, compounding plastics for electrical products and sanding antique furniture from which the paint had been chemically stripped (CDC, 2001), appeared for the first time among California cases of serious lead poisoning.

During the same period, we investigated take-home lead poisoning cases involving 40 children and 1 adult family member. The largest number of take-home cases (13) was in the radiator repair industry. In addition, three cases occurred in home-based businesses involving ceramic tile painting, fishing weight casting, and scrap metal handling. County Childhood Lead Programs identified most of the take-home cases through follow-up of children with elevated BLLs. Many of these children were screened by primary providers following CDC guidelines (CDC, 1997). The number of take-home case referrals from counties has increased greatly from our 1993-94 Registry Report (OLPPP, 1997). The increase in referrals is likely due to OLPPP's training of county Childhood Lead Program staff and the addition of OLPPP's phone number to the Childhood Lead Program home investigation form with a reminder to call us if take-home exposure is suspected.

Several key points emerge from OLPPP's investigation of worker and take-home cases of lead poisoning. As in prior years, lead poisoning cases were linked to lack of training in lead hazards, poor ventilation, improper respiratory protection, unsafe clean-up methods (e.g., dry sweeping), poor hygiene facilities or practices, lack of protective clothing or equipment, and lack of air monitoring data or adequate lead medical programs to guide control efforts. Among small employers, there was frequently a complete lack of awareness about lead hazards and how to control them, even in industries where the risks of lead exposure are well known to occupational health professionals. Many physicians lack experience in handling adult cases of lead poisoning and are unfamiliar with Cal/OSHA's requirements for medical surveillance and follow-up of lead-exposed workers. In some cases, OLPPP had to intervene to prevent inappropriate medical treatment of lead-poisoned workers.

Worker cleaning bullet trap at firing range

Data Limitation: Most Employers Do Not Test

Our interpretation and discussion of Registry data are limited by several problems inherent to the information collected by the Registry. The most serious limitation is that the majority of workers at risk for lead overexposure do not have their blood lead levels tested. Studies of employers in lead industries have found that a low percentage conduct periodic BLL testing. A broad survey of California facilities engaged in lead-using processes found that only 1.4% had routine blood lead testing programs and about 2.6% of potentially lead-exposed workers were estimated to receive routine BLL testing (Rudolph, 1990). A survey of employers in general industry in Los Angeles County found that fewer than half of the surveyed facilities with potentially significant lead exposures conducted routine blood lead testing (Papanek, 1992). Provision of periodic BLL testing varied by industry and company size, with small employers being less likely to have measured worker blood lead levels. Finally, a more recent general industry employer survey conducted in Washington State found that only 17% of respondents who reported that they engaged in lead-using tasks had done BLL testing (Nelson, 1998).

Data generated by OLPPP's census of lead-using industries also indicate that blood lead testing of exposed workers is likely very low in some large industries in which lead is used or disturbed. Between 1996 and 2000, OLPPP conducted a census of the battery manufacturing, nonferrous foundry, radiator repair, and wrecking and demolition industries. For each industry, OLPPP called or mailed a brief questionnaire to all California companies in that industry listed by commercial marketing databases. The questionnaire gathered information on the type of work the company did, their lead use, and their lead safety program.

Of the 15 lead-acid battery manufacturers identified through the census, 13 (87%; covering 95% of the battery workers) had BLL test results in the Registry[11]. Among the 27 lead-using nonferrous foundries[12], 15 companies (56%) had BLL test results in the Registry. Although 340 copper-brass radiator repair shops reported they had one or more employees, there were only 49 radiator repair companies (14%) in the Registry. Finally, although 596 companies reported that they did wrecking and demolition work, there were only 7 wrecking and demolition companies (1%) in the Registry. Although some companies may not appear in the Registry because they maintain employee BLLs below the reportable level of 25 µg/dl, it is unlikely that this could account for the large percentage of nonferrous foundry, radiator repair, and wrecking and demolition employers not in the Registry.

Ceramics manufacturing: Applying a lead-containing glaze

[11] Comparisons here are made for the year in which each census was conducted; i.e., 1996 for battery manufacturing, 1997 for nonferrous foundries, 1998 for wrecking and demolition, and 2000 for radiator repair.

[12] Four companies are excluded because their air lead levels were below the OSHA-required level for BLL testing.

Published reports and OLPPP's census results indicate that although compliance with the BLL testing requirements of the OSHA standards varies by industry, it is likely poor among many industries that use or disturb lead. The result of this large-scale deficiency in testing of lead-exposed workers is that a large proportion of the true number of lead-exposed individuals with elevated BLLs will not be captured by the Registry.

Registry records indicate that even employers who do test may not be providing the periodic BLL testing required by Cal/OSHA. A review of the data for 1995-1999 show that of workers with a peak BLL 25 µg/dl or greater, 52% had 3 or fewer BLL tests in that five-year period, and 27% had only one test. However, this is a rough estimate, since BLLs less than 25 µg/dl may not appear in the Registry, and some workers may not have received additional BLL tests because they left the job.

Data Limitation: Reporting of Lower BLLs Not Required

At present, laboratories are not required to report BLLs below 25 µg/dl. Without reporting of all BLLs we cannot accurately determine the distribution of BLLs among those workers who are tested or calculate rates of lead poisoning in groups and industries of interest. We also cannot evaluate employer compliance with Cal/OSHA's blood lead testing requirement since we cannot distinguish employers not doing BLL testing from those who do routine testing but maintain BLLs below the reportable limit. Finally, we cannot monitor the progress of individual companies or industries in achieving lower BLLs.

Strategies for Improving the Registry

Ideally, the California Occupational Blood Lead Registry would capture a large proportion of the total number of individuals with elevated BLLs ("completeness of coverage") and the information collected would truly describe the occurrence of lead poisoning over time and its distribution by place and person ("representativeness"). In practice, the current system falls seriously short of this ideal for the reasons discussed above. In order to make the Registry a more powerful tool for preventing lead poisoning, we must increase the proportion of employers providing BLL testing, improve the accuracy and completeness of the descriptive information on Lead Reporting Forms (LRFs), and change reporting requirements so that all BLLs are reported to CDHS regardless of level and in a timely manner. Below we discuss current and proposed CDHS and OLPPP activities which will move us closer to these goals.

Revision of Reporting Requirement

CDHS is currently pursuing a requirement for laboratories to submit *all*, not just elevated, BLL test results. Once implemented, this will allow us to: 1) more accurately describe the distribution of BLLs among those workers being tested; 2) calculate rates of elevated BLLs for specific groups of workers (by industry, employer, etc.); and 3) enhance our ability to monitor compliance with the medical surveillance requirements of the lead standards and the progress of employers and industries in controlling lead exposures.

Expanding Routine BLL Testing

Employer failure to conduct routine blood lead testing as required by the Cal/OSHA lead standards is a difficult issue to address. Employers and workers have told us that there are a number of disincentives and barriers to testing. These include: unfamiliarity with occupational medicine and difficulty identifying a medical provider to conduct testing; lack of understanding of the value of BLL testing and the meaning of BLL test results; disruption of work schedules and lost work time; difficulty of scheduling worker clinic visits during work hours; lack of on-site BLL testing services; fear that a high BLL will lead to a Cal/OSHA inspection or a worker lawsuit; belief that BLL testing is unnecessary because other elements of a company's lead safety program are in place; and worker fear that blood drawn for BLL tests will also be tested for illicit drug use.

OLPPP has attempted to address some of these disincentives and barriers as well as motivate employers to test through our educational and other efforts. OLPPP training activities and educational materials include information on Cal/OSHA blood lead testing requirements, the value of BLL testing, and how to set up a lead medical program and interpret and use test results to improve an employer's lead safety program. Individual technical assistance to employers by phone is another way that OLPPP educates employers about their responsibility to provide testing. In addition, under contract with OLPPP, UCLA-LOSH[13] developed a list of occupational medicine providers in the five-county Southern California region to assist employers in identifying lead medical services. Even with these efforts, however, too few employers are providing routine BLL testing.

With this in mind, OLPPP has embarked on a focused effort to develop a strategy for increasing BLL testing among California's industrial construction contractors (iron work, industrial painting, wrecking and demolition). Very high levels of lead exposure are possible in these industries and few employers appear to be testing. To start, we are researching the level of awareness of BLL testing in these industries, who tests and why, what elements in the work environment affect an employer's willingness or ability to provide testing, and what motivates employers to make health and safety changes. We are also asking industry trade associations, unions, and contractors what they would suggest doing to increase blood lead testing in their industry. We will use the results of this research to design an intervention to increase BLL testing among industrial contractors. We plan to do similar work with general industry employers in the future.

Efforts by others, particularly Cal/OSHA, can also have an impact on blood lead testing. One effort by Cal/OSHA, the Lead in Construction Special Emphasis Program, has resulted in an increase in the number of inspections of construction work sites where lead is disturbed. Still, Cal/OSHA does not have sufficient resources to monitor all California's lead industries to insure compliance with the lead standards, including the medical surveillance requirement. With increased resources, Cal/OSHA could have a greater impact on employer compliance with the blood lead testing requirements in the future.

[13] University of California at Los Angeles, Labor Occupational Safety and Health program

Registry Data Guide Our Prevention Activities

OLPPP's list of the ten industries with the largest number of workers reported with elevated BLLs guides our prevention efforts. Since 1995, OLPPP has carried out education efforts in five of these ten industries: residential painting, industrial/commercial construction, radiator repair, scrap metal recycling, and firing ranges.

With residential painting contractors, OLPPP conducted a two-year project to design, implement, and evaluate a multi-dimensional intervention strategy to prevent lead poisoning among house painters (Materna, 2002; Scholz, 2002). Participants received 32 hours of lead instruction, a lead safety manual, industrial hygiene services, and assistance setting up a lead medical program. Using lessons learned from this project, OLPPP later held 34 half-day lead safety awareness seminars around the state, reaching over 1300 residential painters and remodelers. During 1999-2001, six half-day seminars were held for over 500 industrial/commercial construction contractors and union representatives whose work on bridges, commercial building remodeling, and earthquake retrofits involves lead. Currently, OLPPP is providing on-site education and air monitoring to 60 radiator repair shops that were identified by our census as at highest risk for lead exposure.

In Southern California, we contracted with UCLA-LOSH to provide education in lead safety to the scrap metal recycling and the firing range industries. We also contracted with REBRAC[14], a community college-based environmental consulting program specializing in small businesses, to provide on-site technical assistance and air monitoring for 15 scrap metal recycling and firing range companies in Los Angeles, Orange, and Riverside counties.

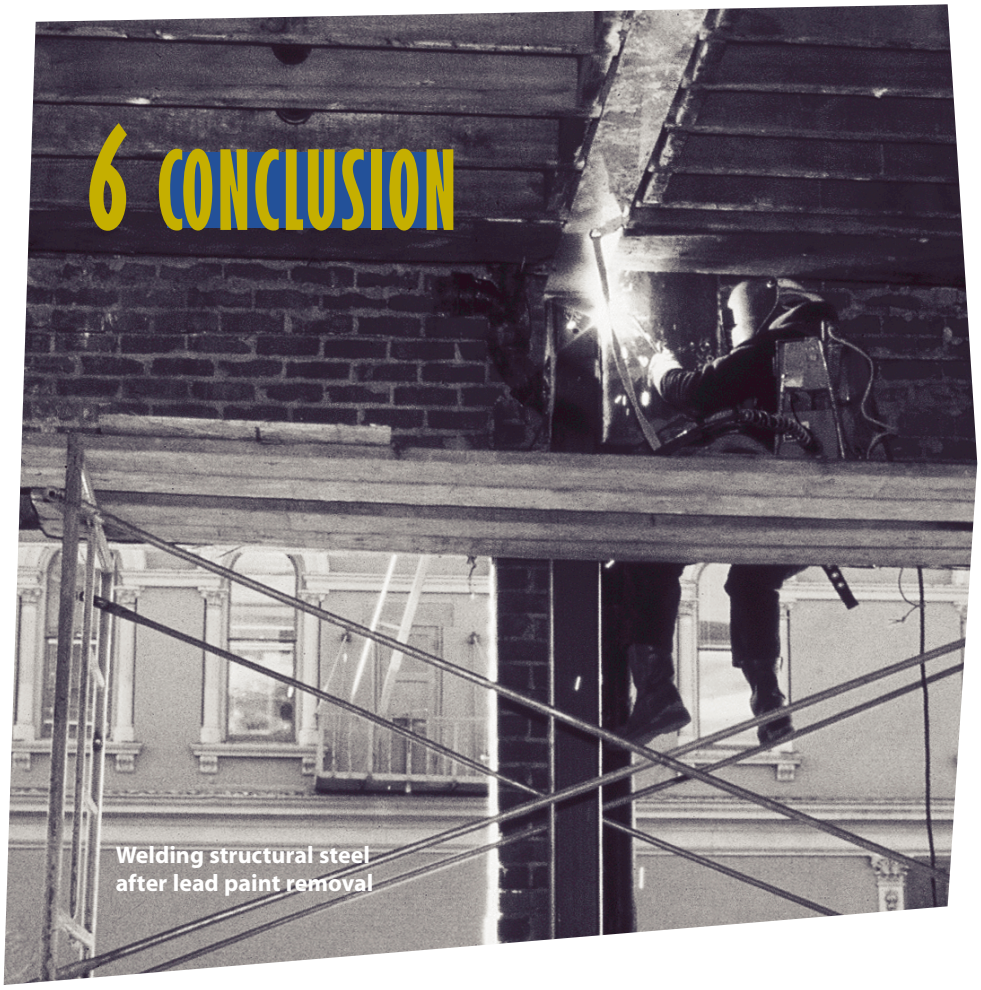
OLPPP continues to develop educational materials, many of which are translated into Spanish since Registry data show that a large percentage of lead workers are Spanish-speaking. Each year OLPPP disseminates these materials to hundreds of lead industry employers, workers, health and safety consultants, government agency staff, and members of the public.

Individual case investigations can also lead to broader efforts to prevent lead poisoning. In follow-up to our investigation of several serious lead poisonings at a plastics compounding company, OLPPP sent an alert letter to 392 California employers in the plastics industries. The letter warned employers of the potential for serious overexposure to lead during compounding of plastics for electrical products. In addition, at OLPPP's request, the industry trade association posted our alert on its web site and included an article about the issue in their membership newsletter.

Bridge work: Cutting lead-painted metal with a torch

[14] Regional Environmental Business Resource and Assistance Centers

6 CONCLUSION



Welding structural steel after lead paint removal

Despite its limitations, the Occupational Blood Lead Registry provides valuable information on lead poisoning in California workplaces. Registry data document that, although it is completely preventable, lead poisoning still occurs on a large scale in California. The problem is widespread and is not confined to a few industries. Through our case management activities we have learned that there is a serious lack of awareness of lead hazards even in industries where the risk of lead poisoning has been long known to health professionals. Small businesses in particular have difficulty establishing adequate lead safety programs and need education and extensive technical assistance. Physicians, nurses, and other health professionals also need education and consultation services, as many are not prepared to care for lead-poisoned workers and are unfamiliar with the OSHA lead standards.

Four census projects completed by OLPPP in the lead-acid battery manufacturing, nonferrous foundry, radiator repair, and wrecking and demolition industries show that, with the exception of battery manufacturing, too few companies are providing BLL testing to their employees. Together with published reports, these data indicate that compliance with the medical surveillance requirements of the Cal/OSHA lead standards is very poor in many industries.

Revisions to the laboratory BLL reporting requirement will improve our ability to calculate rates of elevated BLLs in specific groups of interest, monitor compliance with the BLL testing requirements of the lead standards, and track the progress of particular employers in reducing worker exposure to lead. However, until the majority of employers provide routine BLL testing to their lead-exposed workers, it is impossible to fully describe the magnitude and distribution of occupational lead poisoning in California, identify BLL trends in specific industries, or to draw conclusions with confidence about the impact of employer and public health intervention efforts in high-risk industries.

OLPPP will continue its efforts to increase the number of employers doing BLL testing by educating the lead-using industries, unions, workers, and health professionals about the importance of a lead medical program and employer responsibilities under the lead standards. We will also move forward on developing a specific strategy for increasing BLL testing in industrial/commercial construction. We recognize, however, that Cal/OSHA enforcement is an important partner in addressing the problem of the extensive lack of testing in lead industries. With more reliable and complete tracking data we will be better able to identify problem employers and industries and to make the most of limited resources by carefully targeting our education and intervention efforts.

7 APPENDICES

Appendix A SAMPLE LEAD REPORTING FORM

Appendix B TABLES

Appendix C REFERENCES

Appendix A SAMPLE LEAD REPORTING FORM

State of California - Health and Welfare Agency

Department of Health Services

LEAD REPORTING FORM

Type or print clearly, completing all questions below. ***Laboratory: Use separate card for each sample analyzed.***

Patient Name: Last / First / M.I.

Phone no. where patient can be reached

Race: ☐ White ☐ Black ☐ Asian ☐ Other

Patient Address: Street

Sex: ☐ Male ☐ Female

Date of Birth: M D Y

City / County / State / Zip Code

Age

Social Security No.

DOHS Use Only

Employer at time of Exposure

Phone No.

Occupation

Date Received

Street / City / State / Zip Code

Industry

Patient No.

Sample Source (Check One)
☐ Lab
☐ Physician
☐ Employer
☐ Hospital

Name

Employer Code

Address: Street

Occupational Code

City / State / Zip Code

Industry Code

Physician Requesting Test (if different from source)
Name / City / State / Phone No.

Lab No.

Testing Lab Name	Date Sample Taken	Date Sample Rec'd.	Lab Sample No.	Date Analyzed

Type of Specimen	Lead	EP by Extraction	EP by Hematofluorometer	Hematocrit
Blood	*ug/dL*			
Urine				

This report being completed by: ☐ **Lab** ☐ **Empl** ☐ **Phys** ☐ **Hosp.** ☐ **Check here if you need more report forms**

DHS 8378 (Rev 1/89)

See Reverse for Distribution

Appendix B TABLES

Table 1 OVERVIEW OF BLOOD LEAD REPORTS

Number of Reports, Workers, and Non-Occupational Individuals Reported to the California Occupational Blood Lead Registry, 01/01/95 – 12/31/99

	1995	1996	1997	1998	1999	1995-99
Total Number of Reports	7392	9880	9173	9613	11,848	47,906
Number of Occupational Reports*	7146	9623	8898	9382	11,476	46,525
Number of Workers**	3973	5320	4765	4879	6742	17,775
Number of Non-Occupational Individuals**	78	53	57	67	70	265

* Results are assumed to arise from occupational lead exposure, unless known otherwise. We do not attempt to find out whether exposure is occupational or non-occupational if the BLL is less than 25 µg/dl.

** Individuals with multiple BLL reports in a single calendar year are counted once in each year a result is received. For the 1995-99 column, each individual is counted only once for the entire 5-year period; therefore annual totals for individuals do not add to the number in the 1995-99 column.

Table 2 BLOOD LEAD DISTRIBUTIONS

Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99*

Blood Lead Level (µg/dl)	1995 Individuals (%)	1996 Individuals (%)	1997 Individuals (%)	1998 Individuals (%)	1999 Individuals (%)
25 – 39	801 (80%)	831 (84%)	879 (86%)	706 (84%)	751 (87%)
40 – 49	141 (14%)	127 (13%)	100 (10%)	105 (13%)	89 (10%)
50 – 59	45 (4%)	26 (3%)	27 (3%)	22 (3%)	16 (2%)
60 or greater	14 (1%)	11 (1%)	11 (1%)	10 (1%)	4 (<1%)
TOTAL	1001 (100%)	995 (100%)	1017 (100%)	843 (100%)	860 (100%)

* Individuals with multiple BLL reports in a single calendar year are presented in this table at their peak BLL in each year a result is received.

Table 3 COUNTY OF EMPLOYMENT

Geographic Distribution of Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99*

County of Employment	Number of Workers	Percent	Number of Worksites
Alameda	76	3%	34
Butte	6	<1%	6
Colusa	1	<1%	1
Contra Costa	63	2%	20
El Dorado	1	<1%	1
Fresno	68	3%	12
Glenn	2	<1%	2
Humboldt	2	<1%	2
Imperial	2	<1%	2
Inyo	1	<1%	1
Kern	37	1%	16
Los Angeles	1127	42%	158
Marin	11	<1%	5
Mendocino	2	<1%	2
Merced	25	1%	4
Monterey	7	<1%	3
Nevada	3	<1%	2
Orange	378	14%	34
Placer	4	<1%	4
Riverside	91	3%	17
Sacramento	56	2%	22
San Bernardino	107	4%	27
San Diego	47	2%	17
San Francisco	99	4%	26
San Joaquin	16	1%	9
San Luis Obispo	9	<1%	5
San Mateo	10	<1%	8
Santa Barbara	13	<1%	4
Santa Clara	30	1%	20
Santa Cruz	4	<1%	2
Shasta	4	<1%	1
Solano	13	<1%	7
Sonoma	35	1%	14
Stanislaus	5	<1%	4
Tulare	7	<1%	6
Tuolumne	2	<1%	2
Ventura	8	<1%	4
Yolo	7	<1%	5
Yuba	1	<1%	1
Out of State	20	1%	11
TOTAL	2400	100%	521

* 257 workers with unknown work location excluded.

Table 4 DEMOGRAPHIC CHARACTERISTICS

Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Gender*	# of Workers Reported	(%)
Male	2486	(94%)
Female	161	(6%)
Age, years**		
16 – 19	24	(1%)
20 – 29	523	(21%)
30 – 39	735	(29%)
40 – 49	727	(29%)
50 – 59	399	(16%)
60 – 79	113	(5%)
80 or greater	3	(<1%)
Ethnicity – Surname***		
Hispanic	1370	(52%)
Non-Hispanic	1287	(48%)
TOTAL	2657	(100%)

*10 workers of unknown gender excluded.

** 136 workers of unknown age excluded.

*** Based on U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1980 Spanish Surname List.

Table 5 INDUSTRY SECTOR

Blood Lead Distributions by Industrial Classification (Division), Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99*

Standard Industrial Classification	Total Number of Workers	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater
Mining	10	100%	--	--	--
Construction	429	73%	19%	5%	3%
Manufacturing	1530	81%	14%	4%	1%
Transportation and Public Utilities	7	100%	--	--	--
Wholesale Trade	60	75%	18%	3%	3%
Retail Trade	14	43%	14%	14%**	29%**
Finance, Insurance, and Real Estate	1	100%	--	--	--
Services	319	66%	19%	11%	4%
Public Administration	38	84%	11%	5%	--

* 249 workers with unknown industry excluded.

** Six workers who were employees of a retail gun shop were involved in the demolition of a firing range and had BLLs 50 µg/dl or greater. These workers are classified in Retail Trade.

Table 6 INDUSTRY

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
MINING (SIC 1000-1499)						
1041: Gold Ores	10	0	0	0	10	3
CONSTRUCTION (SIC 1500-1799)						
Construction Industry: Specific Employer Unknown	4	4	0	0	8	--
1521: General Contractors, Single-Family Houses	5	1	0	0	6	1
1522: General Contractor, Other Resid. Bldgs.	1	0	0	0	1	1
1541: General Contractor, Industrial Bldgs.	3	0	1	0	4	2
1542: General Contractor, Non-Residential Bldgs.	13	4	2	1	20	12
1611: Highway and Street Construction	1	0	0	0	1	1
1622: Bridge, Tunnel Construction	21	6	1	0	28	7
1623: Water, Sewer, Pipeline Construction	1	0	0	0	1	1
1629: Heavy Construction	1	3	0	1	5	2
1711: Plumbing, Heating and Air Conditioning	3	1	1	0	5	4
1721: Painting and Paperhanging	112	34	9	9	164	45
1731: Electrical Work	2	3	0	0	5	3

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
1741: Masonry, Stone Setting, Other Stone Work	65	13	3	2	83	2
1761: Roofing, Siding, and Sheet Metal	2	0	0	0	2	2
1771: Concrete Work	0	1	0	0	1	1
1791: Structural Steel Erection	11	0	1	0	12	5
1795: Wrecking and Demolition Work	37	4	2	1	44	14
1796: Installation or Erection of Bldg. Equipment	4	1	0	0	5	3
1799: Special Trade Contractors	26	7	1	0	34	18
MANUFACTURING (SIC 2000-3999)						
2386: Leather and Sheep-Lined Clothing	1	0	0	0	1	1
2421: Sawmills and Planing Mills	2	0	0	0	2	2
2531: Public Building and Related Furniture	1	0	0	0	1	1
2819: Industrial Inorganic Chemicals, NEC	18	4	3	1	26	1
2821: Plastics Materials, Resins, Elastomers	18	3	0	0	21	2
2851: Paints, Varnishes, Lacquers	2	2	2	0	6	1
2992: Lubricating Oils, Greases	0	0	1	0	1	1

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
3087: Custom Compounding of Purchased Plastics Resins	7	5	0	3	15	2
3231: Glass Products made of Purchased Glass	6	1	1	1	9	5
3253: Ceramic Floor and Wall Tile	10	6	0	0	16	6
3261: Vitreous China Plumbing Fixtures	2	2	0	0	4	1
3269: Pottery Products, NEC	35	8	2	0	45	5
3312: Steel Works, Blast Furnaces	1	0	0	0	1	1
3315: Steel Wiredrawing and Nails	2	1	0	0	3	2
3321: Gray and Ductile Iron Foundries	4	2	0	0	6	2
3341: Nonferrous Secondary Smelting	189	40	13	1	243	7
3354: Aluminum Extruded Products	1	0	0	0	1	1
3356: Nonferrous Rolling and Drawing	6	1	2	0	9	2
3364: Nonferrous Die-Castings	0	1	0	0	1	1
3365: Aluminum Foundries	1	0	0	0	1	1
3366: Copper Foundries	98	14	0	1	113	14
3369: Nonferrous Foundries	4	4	1	0	9	4
3429: Hardware, NEC	7	0	1	0	8	1

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
3432: Plumbing Fixture Fittings	10	0	2	0	12	4
3441: Fabricated Structural Metal	3	1	0	0	4	1
3444: Sheet Metal Work	12	6	1	0	19	4
3469: Metal Stampings, NEC	1	0	0	0	1	1
3479: Coating, Engraving, Allied Services	3	1	0	0	4	1
3482: Small Arms Ammunition	4	1	0	0	5	4
3484: Small Arms	1	0	0	0	1	1
3491: Industrial Valves	0	1	1	0	2	1
3492: Fluid Power Valves and Fittings	17	3	2	0	22	1
3494: Valves and Pipe Fittings, NEC	28	4	0	0	32	3
3499: Fabricated Metal Products, NEC	2	0	0	0	2	2
3544: Special Dies and Tools	1	0	0	0	1	1
3561: Pumps and Pumping Equipment	2	0	0	0	2	1
3562: Ball and Roller Bearings	1	0	0	0	1	1
3569: General Indus. Machinery	1	0	0	0	1	1
3645: Residential Electric Lighting Fixtures	1	0	0	0	1	1
3651: Household Audio and Video Equipment	2	1	0	0	3	1
3672: Printed Circuit Boards	7	0	0	0	7	6

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
3675: Electronic Capacitors	1	0	0	0	1	1
3679: Electronic Components, NEC	1	1	1	1	4	1
3691: Storage Batteries	647	97	21	0	765	17
3699: Electrical Machinery	1	0	0	0	1	1
3714: Motor Vehicle Parts	40	3	0	0	43	7
3715: Truck Trailers	1	0	0	0	1	1
3728: Aircraft Parts	18	3	1	0	22	4
3731: Ship Building and Repairing	14	4	2	0	20	3
3949: Sporting and Athletic Goods	1	1	0	2	4	4
3952: Pencils, Crayons, Artists' Materials	5	0	0	0	5	1
3953: Marking Devices	1	0	0	0	1	1
3961: Costume Jewelry	1	0	0	0	1	1
TRANS & PUB UTILITIES (SIC 4000-4971)						
4011: Railroads, Line-Haul Operating	1	0	0	0	1	1
4812: Radiotelephone Communications	1	0	0	0	1	1
4813: Telephone Communications	1	0	0	0	1	1
4911: Electric Services	1	0	0	0	1	1

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
4939: Combination Utilities, NEC	1	0	0	0	1	1
4953: Refuse Systems	1	0	0	0	1	1
4959: Sanitary Services, NEC	1	0	0	0	1	1
WHOLESALE TRADE (SIC 5000-5199)						
5013: Motor Vehicle Supplies	2	1	0	0	3	3
5015: Motor Vehicle Parts, Used	1	2	0	0	3	3
5051: Metals Service Centers	1	0	0	0	1	1
5063: Electrical Apparatus	6	1	0	0	7	3
5093: Scrap and Waste Materials	35	7	2	2	46	20
RETAIL TRADE (SIC 5200-5999)						
5511: Motor Vehicle Dealers	1	1	0	0	2	2
5531: Auto and Home Supply Stores	3	0	0	0	3	3
5941: Sporting Goods Stores	2	1	2	4	9	4
FINANCE, INSURANCE AND REAL ESTATE (SIC 6000-6799)						
6513: Apartment Building Operators	1	0	0	0	1	1

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
SERVICES (SIC 7000-8999)						
7011: Hotels and Motels	2	0	0	0	2	2
7311: Advertising Agencies	1	0	0	0	1	1
7349: Building Cleaning, Maintenance	1	0	0	0	1	1
7363: Help Supply Services	5	0	0	0	5	3
7381: Detective, Guard, Armored Car	0	0	1	0	1	1
7533: Automotive Exhaust Repair	1	0	0	0	1	1
7538: General Automotive Repair	2	0	0	0	2	2
7539: Automotive Repair, NEC (Radiator Repair)	129	47	20	10	206	125
7622: Radio and TV Repair	1	0	0	0	1	1
7641: Reupholstery, Furniture Repair	1	2	3	0	6	1
7699: Repair Shops, NEC	2	0	0	0	2	2
7997: Membership Sports	3	1	1	0	5	3
7999: Amusement, Recreation Services	52	10	19	3	75	29
8051: Skilled Nursing Care Facilities	1	0	0	0	1	1
8062: Medical, Surgical Hospitals	1	0	0	0	1	1
8211: Elementary, Secondary Schools	1	0	0	0	1	1

Table 6 INDUSTRY (Continued)

Blood Lead Distributions by Industry, Workers Reported to the California Occupational Blood Lead Registry with BLLs 25 µg/dl or greater, 01/01/95 – 12/31/99

Standard Industrial Classification	25-39 µg/dl	40-49 µg/dl	50-59 µg/dl	60 µg/dl or greater	Total # Workers	Total # Employers
8222: Jr. Colleges, Tech. Institutes	1	0	0	0	1	1
8331: Job Training, Rehab. Services	1	0	0	0	1	1
8641: Civic, Social Associations	0	1	0	0	1	1
8731: Commercial Phys., Bio. Research	4	0	0	0	4	1
8734: Testing Laboratories	1	0	0	0	1	1
PUBLIC ADMIN (SIC 9100-9721)						
9199: General Government, NEC	4	1	0	0	5	3
9221: Police Protection	10	1	2	0	13	7
9223: Correctional Institutions	2	1	0	0	3	2
9224: Fire Protection	1	0	0	0	1	1
9441: Admin. of Social Programs	1	0	0	0	1	1
9512: Land, Wildlife Conservation	2	0	0	0	2	1
9621: Admin. of Transportation Programs	2	0	0	0	2	2
9711: National Security	10	0	0	0	10	3
TOTAL*	**1865**	**381**	**119**	**43**	**2408**	**517**

* 249 workers with unknown industry excluded.

Table 7 BLOOD LEAD DISTRIBUTIONS – BATTERY MANUFACTURING AND BATTERY RECYCLING INDUSTRIES*

Workers Reported to the California Occupational Blood Lead Registry, 01/01/95 – 12/31/99*

Blood Lead Level (µg/dl)	1995 Individuals	(%)	1996 Individuals	(%)	1997 Individuals	(%)	1998 Individuals	(%)	1999 Individuals	(%)
1 – 24	649	(55%)	1275	(72%)	1283	(73%)	1189	(73%)	1462	(76%)
25 – 39	449	(38%)	435	(26%)	442	(25%)	388	(24%)	428	(22%)
40 – 49	65	(5%)	55	(3%)	40	(2%)	46	(3%)	34	(2%)
50 – 59	16	(1%)	9	(<1%)	6	(<1%)	6	(<1%)	2	(<1%)
60 or greater	1	(<1%)	0	(--)	0	(--)	0	(--)	0	(--)
TOTAL	**1180****	**(100%)**	**1774****	**(100%)**	**1771**	**(100%)**	**1629**	**(100%)**	**1931**	**(100%)**

* Individuals with multiple BLLs reports in a single calendar year are described here at their peak BLL in each year a report is received.

** The increase in reported battery workers from 1995 to 1996 is due primarily to OLPPP's identification of a reporting problem involving 2 large employers.

Table 8 NON-OCCUPATIONAL LEAD EXPOSURE

Sources of Exposure and BLL Distributions of Individuals Reported, 01/01/95 - 12/31/99*

Source	BLL Distribution (µg/dl)					Total	(%)
	1-24	25-39	40-49	50-59	60 or greater		
Retained Bullet	12	31	10	3	4	60	(38%)
Target Shooter	6	21	11	1	2	41	(26%)
Pica	0	6	3	1	5	15	(10%)
Cookware	1	7	2	0	0	10	(6%)
Home Remodeling	0	5	1	1	0	7	(4%)
Family Member of Worker	7	0	0	0	0	7	(4%)
Home Remedy	0	2	0	0	5	7	(4%)
Casting	0	2	1	0	2	5	(3%)
Stained Glass	0	1	0	0	0	1	(<1%)
Hair Dye	1	0	0	0	0	1	(<1%)
Glazing	0	1	0	0	0	1	(<1%)
Pre-natal Exam	1	0	0	0	0	1	(<1%)
TOTAL	**28**	**74**	**28**	**6**	**3**	**156**	**(100%)**

* 109 individuals with unknown non-occupational source excluded.

Table 9 LEAD POISONING CASE INVESTIGATIONS

Industry Associated with Cases with BLL 60 µg/dl or greater Identified by the California Occupational Blood Lead Registry, 01/01/95 - 12/31/99

Standard Industrial Classification	# Workers with BLLs ≥ 60 µg/dl	Range of BLLs (µg/dl)
1542: General Contractors, Nonresidential	1	62
1629: Heavy Construction	1	66
1721: Painting and Paper Hanging	8	60-221
1741: Masonry, Stone Setting, Other Stone Work (Furnace Repair in Lead Smelter)	2	76-90
1795: Wrecking and Demolition Work	1	62
2819: Industrial Inorganic Chemicals	1	69
3087: Custom Compounding of Purchased Plastic Resins	3	108-164
3231: Glass Products, Made of Purchased Glass (Stained Glass)	1	69
3341: Nonferrous Secondary Smelting	1	61
3366: Copper Foundries (Brass/Bronze)	1	60
3679: Electronic Components	1	86
3949: Sporting and Athletic Goods (Fishing Weights)	2	61
5093: Scrap and Waste Materials	1	60
5941: Sporting Goods Stores (Firing Range Demolition)*	4	60-98
7539: Automotive Repair Shops (Radiator Repair)	9	62-96
7999: Amusement and Recreation (Firing Ranges)	2	65
TOTAL	**39**	**60-221**

* Employees of a retail gun shop were involved in the demolition of a firing range and are classified under Sporting Goods Stores.

Table 10 TAKE-HOME LEAD POISONING CASE INVESTIGATIONS

Industry Associated with Family Member Cases with BLL 10 µg/dl or greater Identified by the Occupational Lead Poisoning Prevention Program, 01/01/95 - 12/31/99

Standard Industrial Classification	# Children with BLLs ≥ 10 µg/dl	Range of Children's BLLs (µg/dl)	# Adult Family Members with BLLs ≥ 10 µg/dl	BLL (µg/dl)
1721: Painting and Paper Hanging	1	13	--	--
3087: Custom Compounding of Purchased Plastic Resins	1	10	--	--
3253: Ceramic Wall and Floor Tile	2	21-27	--	--
3269: Pottery Products	2	30-35	--	--
3365: Aluminum Foundries	2	16-21	--	--
3369: Nonferrous Foundries	2	25-27	--	--
3482: Small Arms Ammunition	1	11	--	--
3691: Storage Batteries	1	17	--	--
3949: Sporting and Athletic Goods (Fishing Weights)	1	17	--	--
5093: Scrap and Waste Materials	2	29-40	--	--
5941: Sporting Goods Stores (Firing Range Demolition)*	9	13-34	1	36
7539: Automotive Repair Shops (Radiator Repair)	13	10-52	--	--
7641: Reupholstery and Furniture Repair	3	16-29	--	--
TOTAL	**40**	**10-52**	**1**	**36**

* Employees of a retail gun shop were involved in the demolition of a firing range; their lead poisoned family members are classified under Sporting Goods Stores.

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